

periments are surrounded. These are numerous. *First*, The very fact that we must inflict a wound in our experiment—not wait for the onset of disease—makes it difficult to separate the effects of the wound from the reparative efforts of nature; again, the differences in animals, and their varied nearness or distance from man in the animal kingdom; the variations in the age, bodily vigour, and hygienic condition of the animals experimented on, are all of great importance, and have introduced many fallacies. The enormous length of time required for certain of the experiments—one, two, or more years, and the necessity of repetition for their verification, is also an element of difficulty and delay. The author then gives a history of the theories regarding the regeneration of bone, and experiments on the osseous system. This is divided into two periods or eras, which meet at Duhamel's researches.

A. Before Duhamel: period of pure observation. In this there are few details of cases, and *no* experiments properly so called, if we except a paper by Antonio de Heyde, in 1684, on the formation of the callus in frogs, to which M. Ollier alludes in a foot-note. Hippocrates, Galen, Celsus, down to Parè and Scultetus, had done nothing more than observe cases in which bone had been regenerated, and record observations on them, but made no experiments. In one most interesting case, which is detailed in a foot-note, Scultetus seems to have been on the eve of discovering the practical value of the periosteum. Delamotte, in 1771, published a case in his large Treatise on Surgery, in which he had performed with success a true subperiosteal resection.

B. Period of experiment. The opinions of Duhamel, Fourgeroux, Haller, Dethleef, and Bordenave are briefly discussed, and their experiments contrasted. It is exceedingly interesting to find how age after age controversies repeat themselves. Duhamel held that the periosteum was the tissue which was converted into, and could reproduce bone; Haller and Bordenave told of osseous juice, fluid oozing from the vessels or from the old bone; Troja speaks of "la gelée." A century later, with our improved microscopes and altered nomenclature, we have still the school of the exudate and the blastema waging war with the cellular pathologists who believe in the proliferation of nuclei, the cells of the connective tissue, and the ossific layers of the periosteum; the names of Haller and Duhamel are now changed into Rokitansky and Bennett, Virchow and Goodsir. We are next introduced to the remarkable experiments and theories of Troja, who held that, by destroying the medulla in cases of disease, the old bone might be destroyed and extracted, a new shell having been formed over it. The papers of Coutavoz (1752), David (1770), and Vigorous (1778) are quoted to show the progress made in France in the appreciation of the powers of the periosteum. Vigorous especially seems to have been remarkably in advance of his time; and our author claims for him priority by one year over White of Manchester in excising the head of the

humerus. The opinions of Scarpa and Bichat, the former undervaluing the periosteum and limiting its function simply to that of acting as a mould or limiting membrane, are then briefly described, with the attempt by Dupuytren to revive the theories of Duhamel, and that of Cruveilhier by an eclectic theory to unite the most opposite views. After this, experimenters for a time seem rather to increase in number, but decline in importance till, in 1830, Bernhard Heine of Wurzburg commenced his experiments, so celebrated in Germany. He gave the periosteum the first place in the repair of fracture. After this, well-known names multiply. Syme, Stanley, Jobert, Malgaigne and Velpeau all contributed; and in 1847, Flourens published his important work, "Theorie expérimentale de la formation des Os," of which the following six propositions give the leading conclusions, and may serve to indicate the *status quaestionis* at that date.

1. Bone forms itself in the periosteum.
2. It increases in thickness by layers laid one upon the other.
3. It increases in length by layers laid side by side.
4. The medullary canal increases by re-absorption of the inner layers of the bone.
5. The heads are successively laid down and re-absorbed, to be again laid down as the bone grows.
6. The continual change of the material is the great and marvellous secret of the development of bone.

In summing up this most able and learned introduction, M. Ollier invokes the aid of experiments conducted on better plans than those of his predecessors to prove his points, and says that his adversaries, who must be convinced, are the very same ones who had to be fought with when this century began..

1. Those who believe that the periosteum is useless, and that regeneration of bone can take place without its aid.
2. Those who deny that regeneration of bone can take place even with the aid of the periosteum.

The second or experimental division of the work commences by stating in a single paragraph the constituents of bone, periosteum, marrow, and osseous substance, to which is to be added cartilage, which, however, is in some bones only a temporary developmental constituent. Each of these must be studied separately to ascertain its relative importance in normal and accidental ossification.

1. The periosteum and its *rôle* in ossification are discussed in various series of experiments, of which we have room only for a brief account. Ollier has succeeded in forming artificial bone by the displacement and even transplantation of periosteum. Thus, A : In this series he cut an oblong flap of periosteum, perhaps two inches long and half-an-inch broad, raised it from the subjacent bone (generally the subcutaneous surface of the tibia), and, leaving it attached by its upper end only, twisted it across the muscles so as to bring it nearly or altogether into the form of a ring surrounding

the limb, and secured it in its new position with a stitch. In six or seven weeks the flap was changed into bone, thick, strong, and exhibiting the microscopic characters of true bone. These experiments were made frequently on rabbits, cats, and dogs.

B. In this second series, the flap was raised and fixed as above, but the pedicle of connexion was cut in three or four days, still the bone developed in the flap as before.

C. This is a still more remarkable series: flaps of periosteum were at once raised and transplanted to different parts of the same or different animals, or even animals of a different genus. In almost every case, where the animal was of the same genus, bone formed in considerable quantity in the new position.

The osteogenetic power of the periosteum being thus thoroughly proved, the author next proceeds to inquire in what part or layer of the periosteum this power resides. Though the scalpel cannot define two distinct layers, the microscope shows that the periosteum really does differ in structure in its deep and superficial aspects. Examining the periosteum from without inwards, we find—

1. A thin layer of connective tissue containing fat cells; this hardly belongs to the periosteum at all, but is rather the result of the imperfect separation of the neighbouring cellular tissue. We next come upon a fibrous tissue, closely compacted, formed by small corpuscles of connective tissue united by an intercellular substance in the form of fine wavy fibres, and containing numerous elastic fibres.

2. Turning the preparation and examining it from its inner surface, we find elements entirely differing in appearance, namely, oval or spindle-shaped cells, enclosed in a granular or fibroid intercellular substance. Most of these cells have only one nucleus, but a certain number are in a state of proliferation; those nearest the bone resembling the cells of the marrow with their numerous nuclei.

It must be admitted that the elements of the deep layer, although of similar nature, are at a period of evolution quite different from those of the superficial one. This deeper layer has been described by various histologists,—it is the blastema of ossification of Kölliker, the proliferating layer of the periosteum of Virchow.

The above is a brief resumé of the author's interesting account of the structure of the periosteum. His experiments on the functions of the different layers may be merely noticed.

1. By scraping this inner layer from the outer for a portion of the length of one of his periosteal flaps (left attached at one end and twisted round the muscles), he found, after fourteen days, that the portion which was left unscraped had been ossified as usual, while the scraped portion was only fibrous, though still alive and traversed by vessels extending from the new bone to the old. In other experiments he destroyed the inner layer by cauteries, both actual and potential, and found that, notwithstanding the thinness of the layer left, it still continued to live as a fibrous membrane, but it had quite lost the power of forming bone.

2. Not satisfied by these indirect or negative proofs of the bone-forming power of the inner layer of the periosteum, the following positive experiment was made. The inner layer was scraped from a periosteal flap raised from the tibia of a young rabbit; it was obtained as a whitish semi-liquid matter, containing certain small fragments of membrane. This was sown or planted underneath the skin of the animal's groin. Three weeks afterwards, numerous little solid grains were found in the groin, the largest about the size of a pin's head. Under the microscope some of those were found to be merely calcified, but in others there existed distinct evidence that true bone had been formed.

The author's conclusions up to this point are given in the following sentence :—

"If the periosteum possesses the power of producing bone, it owes this power to its deep layer. This deep layer is the immediate agent of ossification; if the periosteum is deprived of it, it loses its power of ossification. It may, however, perhaps regain at length a portion of its activity, but will never return to its original condition."—P. 94.

A series of experiments are next given, which prove that other fibrous tissues, such as tendons, may possibly calcify, but are not capable of real ossification.

The mode of development and structure of the new bones which the periosteum forms is then described and illustrated, at the end of which M. Ollier, in a few trenchant sentences, expresses his conversion from the blastema theory to cellular pathology.

"We have now recognised that that which we had taken for a new product, an exudation, a blastema, is nothing else than the normal osteogenetic layer, the deep layer of the periosteum, the primitive formative elements of which have become greatly multiplied. . . . The periosteum does not form bone as the liver secretes bile; one cannot make the least comparison between the two phenomena. At the epoch when an osseous juice or fluid, passing successively through various stages of development, was admitted, the confusion was possible; it is so no longer."—P. 110.

Chapter II. discusses the marrow from the same point of view as the periosteum has been discussed. *First*, In a brief history of previous experiments and observations, the few regarding its anatomy, and especially regarding the existence of a true medullary membrane. M. Ollier doubts the existence of the latter, except in the hollow bones of birds. *Second*, In reference to its function, he holds that it is one of absorption, not of growth; that the marrow-cells tend, by absorbing the inner lamella of the bone, to increase the size of its *lumen*, as the periosteum, by adding layer after layer, tends to increase its thickness. He thus objects most strongly to the name, "*internal periosteum*," as applied to the marrow,—first, as *inadmissible anatomically*, as we do not admit the existence of a medullary membrane at all; second, as *physiologically vicious*, on account of the great difference between them in function. *Thirdly*, Experiments prove that the transplanted marrow does *not*

ossify. If a limb be amputated, and a metallic tube be pushed up the hollow of the bone so as to contain within it the marrow, and separate it from the bone, in some rare cases the experimenter has succeeded in obtaining a slight ossification. This may appear to militate against the results of the preceding experiments, but ossification so seldom occurs, and, notwithstanding the great degree of irritation present, it is really so much less in amount than the periosteal ossification, that M. Ollier does not lay much stress on its occasional occurrence. In one of his brief axiomatic sentences, he says,—“*The ossification of the periosteum is a normal fact, that of the medulla an accidental one.*” “Médullisation,” which is the name given by Ollier to the process of formation of a medullary canal in a new bony formation, or in the callus of a fracture, is fully described in a very interesting section. The final stage of medullisation in mammals is conversion into fat, in birds into a hollow cavity containing air. The last section of this chapter contains some experiments (necessarily cruel ones) on the sensibility of the medulla, its vascularity, and its power of absorbing liquids injected into the canal.

Chapter III. is devoted to the bone itself, its structure, and properties. The description of its structure differs little from that given by Virchow in his Cellular Pathology, from which M. Ollier quotes. He experiments,—1. By removing the periosteum. If the wound heals by first intention, it is found that the periosteum is soon reproduced, partly from the periosteum at the edge, partly from the very surface of the bone itself. As might have been expected, if the superficial layer of the bone at the denuded part is destroyed by scraping it, the reproduction of the periosteum is very considerably delayed. But if the wound suppurates, it is generally found that partial or complete necrosis of the denuded portion results. This delays the reproduction and deteriorates the character of the periosteum, which eventually fills up the gap left by the separation of the sequestrum. 2. By destroying and removing the marrow. This operation, which is borne well by birds, is very dangerous to mammals, as might have been expected from the well-known great danger in man of osteo-myelitis. When the animal does survive the operation, the marrow is very rapidly reproduced, and no necrosis need result; indeed, even after total destruction of both periosteum and marrow of a portion of a long bone, necrosis does not necessarily result, the bone being nourished by its attached extremities. In such an injury in man, necrosis would be inevitable.

Chapter IV. describes cartilage, and its rôle in ossification. Several experiments on the transplantation of cartilage gave different results, according to the particular cartilage, the relation of its perichondrium, and its new site; as a general rule, however, very little ossification resulted, and in many of the experiments the cartilage was rapidly absorbed.

Chapter V. seems to us a most valuable one; it records comparatively few experiments, but some most striking observations, and is throughout full of the most philosophic generalization. It discusses the effects of traumatic irritation on the different parts of the bone and on the adjacent tissues. We can here only briefly detail the chief heads of the observations. 1. Irritated periosteum forms new bone even in aged animals, where the natural bone-forming process of the periosteum had ceased. 2. Irritated marrow, though exceedingly apt to pass into suppuration, sometimes fulfils its rôle of medullisation, absorbing layer after layer of the bone. In young animals, M. Ollier succeeded occasionally in obtaining complete reabsorption of the bone by irritation of the marrow, so that only marrow and pus remained enclosed in an external envelope of new bone, which in the meantime the periosteum had been forming. Such experiments explain the not uncommon cases of almost complete reabsorption of inflamed phalanges; and also the peculiar soft condition of the long bones so often seen in the neighbourhood of carious joints, even where there has been no suppuration. The same amount of injury seems to produce very different effects in different animals, according to their state of health and kind of constitution. What will cause suppuration in one, will produce only a thickening of the periosteum in another, or a layer of new bone in a third.

The neighbourhood of the periosteum is then shown to have an effect in determining the results of irritation in other tissues, such as the fibrous or synovial, and this explains the new formations in and about joints after irritation, whether traumatic or rheumatic. A most interesting section follows, which traces the relation between osteitis and necrosis. Ollier proves that mere destruction of the nutrient vessels of a portion of bone, by isolating it simultaneously from the periosteum and marrow, need not result in necrosis, so long as the bone does not inflame. Inflammation of the bone at once obliterates the capillaries, for, enclosed in narrow canals which are incapable of dilatation, the least inflammatory thickening presses on the capillaries, cuts off the supply of blood, and then, and not till then, the bone dies. This it is that best explains the far greater frequency of necrosis from similar injuries in adults than in children. For an interesting discussion of the various opinions on the possibility of absorption of dead bone, we must simply refer to the rest of this most valuable chapter (pp. 192-199).

Chapter VI. is on the repair of wounds of bone, and the formation of callus. A large number of experiments on wounds give results so thoroughly consistent with the foregoing chapters as to require no detail. The subject of reunion of fracture, so much discussed, and enveloped in such a mist of words, seems to M. Ollier and those who follow him to be not so difficult after all. He briefly describes certain varieties depending on the nature of the injury.

1. Subcutaneous fractures with or without tearing of the periosteum.

Subperiosteal fracture is not uncommon, especially in the clavicle and tibia, when the injury has been direct, and there has been little or no displacement. There is little irritation, a prolonged spindle-shaped swelling occupies the neighbourhood of the fracture, and the periosteum is the chief agent in repair. 2. Where the periosteum has been ruptured and the fragments project through it, the flap or bridge which remains connecting the two ends plays a most important part; it ossifies, joins the ends, and by degrees the corners of the shaft which remain connected to this bridge are gradually rounded off and worn away by the efforts of the marrow, and the continuity and shape of the limb restored. 3. The marrow has its work too, chiefly in old subjects, in ossifying after a fracture and forming a bolt or pin which aids in fixing the ends. This is speedily reabsorbed in young animals or children, in adults it may remain unchanged. The work of the soft parts and the specialties of compound fractures are then noticed; and all is summed up in a section entitled "The Theory of Callus," which seems a very fair exposition of the present state of the question. A curious experiment gave the most natural results. M. Ollier deprived the tibia of a rabbit of its periosteum, and allowed the place to heal. Three weeks after, he fractured it at the same spot. The fracture re-united, but very much slower than it should have done. Certain results of experiments on fractures can here only be noticed. Continued irritation by rubbing, pricking, inserting setons, etc., seems to delay union and even cause absorption of the callus. Weak health retards—gestation seems not to affect—and phosphated salts do not hasten—the union of a fracture. Section of the nerves of the limb seems to have little or no effect on the repair. A notice of wounds of cartilage and their mode of union concludes the chapter.

Chapter VII. treats of the regeneration of bone in general. The chief experiments on this subject were made on the radius of young rabbits. There were four series: briefly, the results were as follows:—1. The whole of the periosteum preserved, and bone removed, resulted in complete restoration of the bone. 2. Removal of the bone with most of the periosteum, but leaving here and there fragments of periosteum, resulted in bony fragments corresponding exactly to the portions left. 3. Removal of the periosteum and bone entire, leaving carefully the cellular layer above the periosteum, and cutting the tendons as close to the bone as possible, resulted in a band of fibrous tissue. 4. Removal of the periosteum and also the neighbouring soft parts, including a layer, more or less thick, of the tendons, resulted in no reproduction of the bone at all. These all coincide in showing the immense importance of the periosteum, and the only exceptional powers of the soft parts. A series of similar experiments on the powers of the marrow in regeneration give almost negative results.

Chapter VIII. gives some most curious and surprising results

of experiment on the reproduction of different bones after their complete removal. We have no room for a resumé of the various experiments; suffice it to say, that in young dogs Ollier removed the whole humerus in one, the whole scapula in another, the vault of the palate in a third, with complete reproduction of new bones with all the attachments of muscles complete, in periods varying from one to five months. Less remarkable at first sight, but still very interesting, are similar experiments on the cranium, by trepanning, and on short bones by excision.

Chapter IX. opens a new and very important practical question, which, more even than the preceding chapters, has a bearing on many most frequent surgical operations. It discusses the "Formation of new joints between the reproduced articular extremities," or, in other words, the formation of false joints after resections. M. Ollier naturally strongly supports the preservation of the periosteum and the capsular ligaments, as far as this may be done, in resections. He thus contrasts the results of the two methods.—

1. In resections in which the capsular ligament and periosteum have been preserved, we have "reproduction of the heads of the bones, preservation of the joint, and separation of the extremities, or else a union by a mere cellular tissue, in which may be traced some of the characters of a synovial membrane, occasionally even an attempt at an inter-articular fibro-cartilage may result." 2. In ordinary resections where the periosteum and capsular ligament have been removed, "the heads of the bones are not reproduced, no joint remains, the ends of the bones are united by a fibrous band varying in thickness."

We must own that our experience of resections, specially of the elbow-joint, in Edinburgh, does not bear out M. Ollier's results. We find that the chief risk is not that too much be removed, but too little, and that it is quite unnecessary to leave the periosteum. Many cases have shown the admirably useful joints which may be obtained, and one or two dissections have proved the nearly perfect reproduction of joints in which no care was taken to retain periosteum, and in which not only all the synovial membrane, but the ends of the bones were very freely removed.

Some of M. Ollier's experiments on animals bear out his view, that so far a better result can be obtained *in them* when the periosteum is retained than when it is removed. For in young dogs, when he removed the whole articulation, the elbow remained useless; the fore-arm, at the end even of six months, remained atrophied and flapping; while, when he retained the capsule, the ligaments, and periosteum, removing only the bones, he obtained joints which, while strong to resist lateral movement, were able to be flexed and extended.

Chapter X. briefly groups the results of experiment on the mode of development, and the structure of reproduced bones and of new joints.

Chapter XI. details the conditions of age, method of operating, and general hygiene, which are needed to ensure success in the experiments; and also describes a few of the artificial methods which may be used to stimulate and increase reproduction of new bone.

Chapter XII. is of very great value in a physiological point of view, as it enters very fully into the interesting question of the manner in which bone grows, and especially into the laws which govern the growth of the long bones of the limbs. The author sums up in the following brief sentence the broad differences which exist between the growth of soft parts and that of bones:—

“Growth is in fact quite different in the soft tissues from what it is in bone. In the former it is interstitial—in other words, it acts by the interposition of new anatomical elements *between* the ones already existing. In the latter, on the other hand, growth takes place by the deposition of new elements—the osteal cells, fixed at regular distances by the want of extensile power in the calcareous substance, cannot separate to give place to new elements, which must arrange themselves either inside or outside of the layer already formed. We may contrast the growth of bone with that of the soft parts, by saying in a single word, that the former is peripheral, the latter interstitial.”

The well-known experiments of Duhamel, Flourens, and others, of obtaining variously coloured layers, by including or withholding madder from the food of animals, are then referred to; and then the more accurate ones, by the insertion of nails, are recorded and repeated.

The latter kind were thus performed. Two small nails were inserted into the tibia of a rabbit ten days old, at a certain measured distance from each other. Ten months afterwards, on the animal being killed, the bone was found at least three times its former length, and yet the nails preserved the same original relation to each other, though the epiphyses had separated so far. The next difficulty is to explain the changes in form which bones undergo during their growth—the jaw of an adult being not merely the enlarged jaw of a child, but having a different shape. For this purpose M. Ollier cites and adopts John Hunter’s term of “modelling absorption” for want of a better term, but explains that the changes in form are the result not only of absorption of bone at one place, but also of accumulation of new bone at another part.

The remarkable facts regarding the inequality of the increase of different ends of the long bones of the limbs lately discussed by Dr Humphrey of Cambridge (Med.-Chir. Transactions, vol. xliv.) are confirmed by M. Ollier. These variations have an important practical bearing on the subject of resections on infants, and are well worth the careful study of surgeons. Experiments, and even conclusions, are far too long to give here; but we may quote the two propositions with which the section closes:—

1. In the upper limb the extremities of the arm and fore-arm, which together form the elbow-joint, grow *less* than the others do.
2. In the lower limb the extremities of the thigh and leg, which together form the knee-joint, grow *more* than the others do.

This explains, what every practical surgeon must have observed, why excisions of the elbow in young children are much less likely to be followed by arrested development of the limb than those of the knee, while resections of the shoulder and wrist are more likely to cause arrest than those of hip and ankle.

It also explains in a most interesting, and, we believe, thoroughly scientific manner, the frequency of malignant tumours of the lower end of the thigh and head of the tibia, compared with the rarity of such near the elbow. It also bears a close relation to the specialties in the development of rickets.

Chapter XIII. describes experiments on the influence of irritation and removal of different portions of bones on their subsequent growth, and on the effect of dividing nerves.

Chapter XIV. recounts some curious experiments made on the possibility of grafting bones (*a*) by *transplantation of the periosteum*:—

1. From one part of the same animal to another.
2. From an animal of one species to one of another. Out of sixty experiments only one succeeded, and that partially.
3. From dead to living animals. Some experiments succeeded twenty-four hours after the death of the animal.

And (*b*) by *actual transplantation of bones*, or pieces of bones, still surrounded by periosteum, and enclosing marrow.

Our analysis of this first volume has already run to such a length that we can quote no more of these very curious experiments, but must simply refer the reader to the original. For the present we have left ourselves no room for criticism. Indeed, so far, there is little need for it; the experiments are so numerous and precise, the results tally so well with each other, and leave the impression of so harmonious a whole, that really, unless by a similar series of experiments, with different results, M. Ollier's facts could be controverted, there would be little use assaulting his *theories*. And even were this done and negative results obtained, it would still remain for the dexterous French surgeon to say, "Your results are not like mine, because you have not proved yourself so neat-handed an experimenter, nor so close an observer."

We reserve for another occasion a notice of the second volume of this monument of industry.

Chemistry, Inorganic and Organic. By Prof. BLOXAM. London: Churchill and Sons: 1867.

THIS is a Manual of Chemistry written on the old plan, and although exception will no doubt be taken to it by advanced theorists on account of its antiquated notation and want of systematic arrangement, every one who takes the trouble to read it will admit that it is an excellent book. The science is at present in a transition

state, and chemists are apt to forget that there is a large class who take no interest in our theoretical discussions, but who are practically interested in chemistry. For this class of readers the book before us is specially suitable. A large proportion of it is devoted to the applications of chemistry, and metallurgical and manufacturing processes are fully and clearly explained. In his short theoretical remarks the author has, on the whole, very fairly represented the views now generally held; the only exception we have observed is in his notice of the doctrine of atomicity, p. 153, where he gives peroxide of hydrogen the graphic formula $H-O''-H-O''$ (instead of $H-O''-O''-H$), thus making one atom of hydrogen diatomic. An error of this kind is not of much consequence in a book so purely practical as this, still, if the subject was to be alluded to at all, the author might have taken the trouble to make the allusion accurate.

The book is carefully printed and is illustrated with a large number of new and instructive woodcuts. We can cordially recommend it to all who prefer what is generally called the "old system of notation," and believe that even the more "modern" chemists would not find the time spent in its perusal altogether thrown away.

Erkennung und Behandlung der Prostata-Krankheiten. Von HENRY THOMPSON, Arzt am Londoner Universitäts-Hospitale, so wie in St Marylebone, Mitglied der Société de Chirurgie in Paris, etc. Autorisirte deutsche Ausgabe, mit 25 in den Text gedruckten Holzschnitten und 2 Farbendrucktafeln. Erlangen: Verlag von Ferdinand Enke: 1867.

Recognition and Treatment of Diseases of the Prostate. By HENRY THOMPSON, Surgeon in University College Hospital, and to the Marylebone Infirmary, Fellow of the Société de Chirurgie in Paris, etc. Authorized German edition, with 25 woodcuts in the text, and 2 chromolithographs. Erlangen: Ferdinand Enke: 1867.

DR THEILE, the translator, expresses his sense of the great value of British contributions to the subject of Diseases of the Prostate, and implies that this may be in part due to the greater frequency of the disease in this country.

Sprengel and Keil had already done for Home and Adams what Theile has now done for Mr Thompson, whose careful and original observations well deserve the honour of a good translation. The translation seems close and sufficiently accurate; a trivial alteration is made in the arrangement of the chapters; and only two of Mr Thompson's thirteen plates are reproduced, and these in a style very much inferior to that of Mr West.

Part First.

ORIGINAL COMMUNICATIONS.

ARTICLE I.—*The Life, Character, and Writings of William Hey of Leeds: a Discourse delivered at the Annual Meeting of the Harveian Society, Edinburgh, April 12, 1867.* By BENJAMIN BELL, F.R.C.S.E., President of the Society.

WHILE thinking of a topic which might be suitable for this Harveian Discourse, it occurred to me that a biographical sketch of that eminent surgeon, the first Mr Hey of Leeds, might be acceptable to the Society, particularly to the junior members, who are less likely to be acquainted with his merits. His life was written nearly fifty years ago, by his pupil and friend the late John Pearson, surgeon to the Lock Hospital in London; and no one can read the work without perceiving that the subject of it must have been not only distinguished in his profession, but remarkable as a useful citizen, and a man of the highest moral and religious character. Still, the book is defective in its arrangement, contains a good deal of irrelevant matter, and fails, I think, in bringing out with sufficient prominence, what I believe to be true, that Mr Hey was, as a professional man, really in advance of his time, and contributed largely towards the improvement of practical surgery. Although practising in a provincial town, and contemporaneous with many surgeons, both in London and elsewhere, of distinguished reputation, men, who not only improved the practice, but established the principles of scientific surgery, Mr Hey, if I mistake not, was quite on a level with the best of them, as a wise, sagacious, and successful practitioner. His long life made him contemporary with a number of bright names in our profession. When Cheselden died, he was fifteen years of age. John Hunter was born (1728) eight years before him, and died (1791) when Mr Hey was fifty-five. Samuel Sharp died (1778) when Hey was forty-two, and Percival Pott (1713-88) ten years later. B. Bell was his junior by thirteen years (1749-1806), and predeceased him by twelve. Desault was eight years younger than Hey (1744-95), and predeceased him by twenty-three. Coming still farther down, he was contemporary with John Abernethy (1765), Astley Cooper (1768), John Bell (1762), Charles Bell

therapeutics at all, they must seek by enlarging their sphere of observation to render them such as may be capable of simplifying the future by explaining the past in accordance with facts, and with our present scientific knowledge, and avoid those limited and narrow-minded glimpses of disease which as yet have led to nothing more than startling "Eurekas" from every quarter of the compass, bewildering alike by their number and diversity.

Traité expérimental et clinique de la Régénération des Os, et de la Production artificielle du Tissu osseux. Par L. OLLIER, Chirurgien-en-chef de l'Hôtel Dieu de Lyon. Avec 9 planches gravées sur cuivre, et 45 figures intercalées dans le texte. Tome second. Partie clinique. Paris: Victor Masson et fils: 1867.

Experimental and Clinical Treatise on the Reproduction of Bone and the Artificial Production of Osseous Tissue. By L. OLLIER, Senior Surgeon to the Hotel-Dieu of Lyons. With 9 copperplates and 45 woodcuts. Vol. II. Clinical Part. Paris: Victor Masson & Son: 1867.

[SECOND NOTICE.]

IN the first volume of this elaborate work we found laid before us the results of a vast number of experiments, explanatory of the structure of bone, the laws which regulate its growth and development, and the possibility of its reproduction or transplantation. These being performed on animals, have rather a physiological and scientific than a surgical and practical bearing. In this second volume the author endeavours to reap the harvest of the seed so abundantly sown, to find the practical value of the information already obtained. It is accordingly illustrated by cases more than by experiments; and dealing with opinions which may be opposed, rather than with long series of experiments which must be repeated before they can be contradicted, the style is necessarily argumentative and controversial as well as didactic.

Chapter I., on necrosis and reproduction of bone, begins with a definition of the two chief varieties of necrosis, and their respective chances of a good reproduction, so short, so clear, and (without being original) so well put, as to justify an almost verbatim quotation. The almost epigrammatic brevity and brilliancy of M. Ollier's style in his best bits are very difficult to imitate, far less to reproduce in our more sober English.

The Different Varieties of Necrosis.

"Occasionally necrosed bones resemble portions of healthy bones, at other times they present the appearance of diseased bones. In the one case the sequestrum presents, to the naked eye and the microscope, the characters of normal bone, in the other it resembles inflamed bone, frequently rarefied in texture, sometimes eburneated; the death of the part in itself making no

alteration in the original characters of the tissue. This difference of appearance indicates the two chief modes in which necrosis occurs. In the first, the bone dies, as it were, before it has been sick. It passes rapidly, under the influence of an acute inflammation, from life to death, and this we call *simple or primitive necrosis*. In the second, the bone has been already diseased before its death; it has undergone various changes under the influence of inflammation; it has become opened out, vascular, and softened. The death has been secondary, often by a long interval, to the commencement of the disease: this we call *carious or secondary necrosis*.

"Between these two types there exist, doubtless, intermediate varieties, as there are between the sudden gangrene of a limb, the result of obliteration of its principal artery, and the loss of the same member by the successive mortification of its various structures, under the influence of a low type of inflammation, or of phagedænic ulceration.

"These two varieties of necrosis differ very remarkably in the point of view of the future reproduction of the bone.

"After a simple necrosis, the periosteum, unless already destroyed by the violence of the inflammation, will set itself at once to reproduce a new bone.

"After a cario-necrosis, on the other hand, the original malady runs its course, if the general diathetic conditions which maintain it still remain; the necrosis is merely an *accident* of the disease, unless, indeed, it removes all the carious portion; in that case it is its *termination*.

"No repair of bone goes on, for the tissues which ought to contribute to it are themselves altered; it confines itself merely to peripheral osteophytes. The periosteum fungates, and is more or less destroyed up to the very border of the altered bone; and without the intervention of art the disease has no tendency to cure. The sequestrum not being in itself the whole disease, it is necessary to attack the caries."

The rarity of complete necrosis of a diaphysis, and the influence of age, are next discussed and illustrated by cases. One is so rare as to deserve mention. A girl, æt. 12½, had suffered eight and a-half years before admission from every symptom of necrosis of the femur. Only small fragments of bone had escaped. The limb was slightly longer and rather thicker than the sound one. Sinuses existed. The entire diaphysis of the femur of a child of four was easily removed from the centre of the new bone.

When are we to interfere surgically in cases of necrosis? is the next question. The amount of irritation and suppuration caused by a sequestrum may determine its removal before the new bone is sufficiently firm, for the advantage of the stimulus to ossification afforded by its presence is more than counterbalanced by the risks to the health from profuse suppuration. That, except in special cases (such as necrosis of the jaw), necrosis should not be touched before it is detached, is a very general rule. We, in this country, have little experience in means for hastening exfoliation. M. Ollier's conclusion is, that while shaking them may do harm, solvent injections are useless if feeble, irritating if strong. He also reports, as might be expected, that trepanning a dead frontal bone in various places did not in the least hasten its separation, as the half which he let alone was not behind the half which he scraped and trepanned in various places.

Chapter II. treats of losses of substance which do not affect the

length of the bone, under the three heads of abrasion, "évidement," and cauterization. Comparatively little is said under the heads of abrasion and cauterization, with the means by which nature repairs the losses of bone. Under "évidement," which may be translated by "gouging," or "hollowing out," or "scooping out," we have a very full description, and a free criticism of M. Sedillot's well-known method of treating diseased bones and joints. We have no room to quote, nor could we well abbreviate the argument, but the result is, that M. Ollier strongly upholds his own "subperiosteal resections" against the "gouging" of the famous surgeon of Strasburg. The operation which Chassaignac has called "égrugement" or "scraping," M. Ollier places in the same category as the "évidement." To those interested in the brisk warfare on the subject of these various though so similar operations, this chapter will afford much information.

Before leaving the subject of the comparative merits of the methods of operating devised by these eminent surgeons, it may be interesting to allude to—and even to quote a sentence or two from—the report of the sub-committee of the French Academy regarding the "grand prix de chirurgie." The prize consisted of 10,000 francs given by the Academy, with an equal sum added by the Emperor, and the subject was, "Preservation of Limbs by the Preservation of the Periosteum." As is well known, the prize was divided equally between MM. Sedillot and Ollier.

"If we listened to one of these authors only, it would be necessary completely to reject all the labours of the other. But looking at the subject with care, it is not difficult to bring the difference in their opinions back to a common result. . . . Each has its own advantages. . . . To form a new nose, to close fissures in the palate, M. Ollier's method has undoubtedly great value. On the other hand, it is clear that the plan of gouging bones is more suitable than periosteal resection in adults or the aged; and that each method may aid the other without excluding it. This it is which has led the sub-committee to propose that the prize should be equally divided between the two authors."

Chapter III. treats of the reproduction of bone by periosteal flaps, and consists very much in a series of proofs from clinical facts of the opinions previously supported by experiments on animals. The first case is long, but well worth perusal. It demonstrates the possibility of the reproduction of bone after the complete subperiosteal resection of a large piece of *living* (not *necrosed*) shaft. The upper part of the humerus of a girl (æt. 15) was diseased, not dead, the periosteum was detached during the operation, and a piece, nearly five inches in length, including the head and tuberosities, was removed. A very good arm, little more than two inches shorter than the other, resulted.

A historical sketch of such periosteal resections is then given, including reports of the cases of Delamotte, Coutavoz, Vigaroux, and White of Manchester, the last three being quoted *verbatim* in an appendix.

While some surgeons deny the possibility of the regeneration of bone by the periosteum, there are others who believe that this may take place independent of its assistance. The first say the periosteum is insufficient, the others say it is useless, or at least that its place can easily be taken by the surrounding soft parts. Bones are reproduced, they say, yet we took no heed of the periosteum. Ollier explains these cases, to his own satisfaction at least, by the following observation:—"These cases are chiefly in children, and, if not, in adolescents. Now it is impossible at that age to make your resections anything else than subperiosteal, for the *periosteum then adheres more firmly to the soft parts than to the bone itself*. It is impossible to make a compound fracture of a child's limb and project the bone without its being completely stripped of the periosteum. Hence, in such cases, surgeons perform subperiosteal resections without wishing to do it, and without knowing that it has been done.

Chapter IV., on subperiosteal resections, begins with a section which we may epitomize in a single sentence. Subperiosteal resections are not merely conservative but reparative operations. The author then demonstrates the *possibility* of such operations. Surgeons who object that the preservation of the periosteum is impossible in the living subject, have forgotten two anatomical facts which are easily verified: one, a fact of healthy anatomy, that the periosteum in youth is thick and easily detached; the other, of pathology, that in inflamed bones also the conditions are the same.

Rules for operation are then given of so thoroughly practical a nature as almost to deserve quotation entire. We have room only for the heads of the subject. 1. Incision of skin should allow the bone to be reached by the shortest road. 2. Deeper incisions. If possible neither muscles nor tendons should be cut. If a muscle must be cut, cut it so as not to cut its nerve. Cutting muscles at all has a double danger—paralysis and new insertions in wrong places. 3. Raising of the periosteum, by rugines or scrapers, generally sharp only at one edge, and varying from the old form by having their cutting edge in the axis of the instrument, not across it; and by a straight instrument called "détache-tendon." These instruments are figured and carefully described. 4. Sawing of the bone, generally by chain-saws and with certain precautions. The treatment by splints, bandages, and extension, is then carefully described.

Conditions favouring reproduction by periosteum in man: Age. The years between 13 and 15 have given the most favourable specimens. Up to 20, or even 25, the periosteum still possesses its power of reproduction. After 30 or 35, it is impossible to trust to any reproduction *from healthy periosteum*, i. e., *not prepared by a previous inflammatory attack*.

Anæmia, erysipelas, the exanthemata, have all, as might have been expected, delayed or prevented reproduction of bone.

Chapter V., on the subject of the general indications for subperiosteal resections, begins with some very sensible remarks on the differences between the chances of patients in hospitals, in private practice, and in military campaigns—pointing out the comparative risks in hospitals of any operation which involves (as subperiosteal resections must do) prolonged suppuration, and the greater chances of recovery in private practice, especially in the country, and even during a campaign, if the general hygienic conditions are good.

It then goes on to discuss the various maladies or injuries of bone in which subperiosteal resection may be used—under four heads:—

1. In compound comminuted fractures.
2. In inflammation of bone and suppurating articular extremities.
3. In organic lesions of bone. In these it can very rarely be applicable, never in malignant growths; only in very rare cases of benign cysts, or certain enchondromata.
4. In cases where it is necessary to remove a bone or portion of bone as a preliminary step to operating on parts below, as when the upper jaw is removed to get at a fibrous polypus, or when one has to trepan the skull.

Chapters VI. to IX. inclusive, are devoted to the details of such cases of subperiosteal resections of *bones* as the author has watched to a conclusion in his own practice, or obtained in the practice of others; while chapters X., XI., and XII., contain similar experiences in the treatment of the principal *joints*. By referring to a few of the more important cases, we may give the reader a specimen of what these practical chapters contain, and how the previous experiments are now made to bear upon practice.

In trepanning, if we make the incision right down to the bone, and then carefully scrape off the periosteum and retain it with the flaps, we may almost be certain to obtain entire reproduction of bone even in adults.

Excision of the upper jaw may be requisite for tumour: in such cases the periosteum should not be preserved; or for necrosis. Here, again, it is unnecessary to trouble about it, as nature has already effected its separation from the bone. But in cases where the upper jaw has to be removed to gain access to a tumour behind it, then the periosteum both can and ought to be preserved. One such case is recorded, where the jaw was reproduced in front, but the palate portion did not ossify. Full details are given both of the method and its results.

In excisions of the lower jaw, M. Ollier recommends that an attempt should be made to preserve periosteum, especially of the outer surface of the bone. He then recommends that the bone should be sawn in front at the point where it is to be removed, and then the muscles adherent to the part to be taken away should be separated from their attachments by the *détache-tendon*, so that not a fibre should be cut; this can easily be managed in young subjects.

That then the bone, which is now mobile, should be seized by strong forceps and forcibly torn or twisted from its attachments at the joint. This latter procedure, which sounds severe and barbarous, has been proposed and performed by Maisonneuve, and strongly opposed by Chassaignac; but M. Ollier claims for it less risk from haemorrhage or from injury of the important structures in the vicinity of the joint. In one recorded case it seems to have been easy and the result favourable.

In resection of the bones of the trunk, if a *rib*, or part of a rib, requires to be removed for necrosis, it is generally easy to do it subperiosteally, for the periosteum is already thickened and detached by the disease. If it be thus done with care there need be no fear of injuring pleura or intercostal artery, and the result is almost sure to show abundant ossification. The *clavicle*, if necrosed partially or entirely, can generally be very easily removed, and the periosteum which remains provides in time a most efficient substitute. Complete necrosis seems to be rare, as M. Ollier has no cases of his own to report, and can find only three to quote. Last August a case occurred in Mr Syme's hospital practice, in which, after a very severe muscular effort in a strong man of 35, the whole diaphysis had become necrosed, and was very easily removed by freeing one end by an incision, and then drawing the pure white bone out of the gutter of periosteum in which it lay, and which had already (six weeks after the injury) formed a very efficient protection to the vessels and support to the shoulder.

Subperiosteal excision of the scapula has not yet been performed on the living subject. M. Ollier gives very precise directions for its performance on the dead subject, which, however, we fear would be impracticable on the living; for the shock and haemorrhage involved in the removal of so large a bone would be much and probably fatally increased by the prolonged dissection required. He is not so well informed as usual in the history and results of this operation, as he seems to be aware of three cases only, Langenbeck's, Jones', and Syme's first.

A rare and interesting case of subperiosteal resection of the *symphysis pubis* for necrosis is recorded, in which the patient was cured, and the bone was reproduced.

A subperiosteal resection of the *coccyx* concludes the account of these operations as practised on the trunk.

Resections of the humerus in whole or part are not very often needed. M. Ollier strongly recommends that, in cases of compound fracture with comminution, the splinters should be carefully removed, leaving the periosteum; and portions of bone which have been deprived of periosteum, even if not broken off, should be also cut away with saw or pliers, there being little risk of a false joint, and much less fear of prolonged suppuration, if only enough periosteum be retained.

Resections of the bones of the forearm are illustrated by one or two interesting cases. When we remember, however, the remarkable

reproductions of bones of the forearm, even where no care has been taken to retain the periosteum,¹ when the patients are young, we must not lay too much stress on any special precautions in that direction.

On the subject of subperiosteal resections of the whole thickness of the shaft of the *femur*, M. Ollier very wisely observes that in a great hospital these operations are so very dangerous, that he would prefer amputation of the thigh as affording a better chance of recovery. Subperiosteal resections of the *tibia* are rendered easy of performance by the subcutaneous position of the bone, and have one great element of success secured by the immobility which is given by the presence of the fibula; hence there exists a considerable number of cases already, and there is more likelihood of such procedures being generally adopted than in the cases of the femur or humerus. M. Ollier gives a large series of cases, in some of which, including one by Mr Holmes, the results have been very satisfactory. In describing the operation, very full details are given: the chief points to be attended to are, that the incisions through the periosteum should be made in the axis of the bone, and that after the periosteum has been carefully separated from the bone about its centre, a chain-saw should then be passed round it, guarded by a grooved director, and thus the bone should be fairly cut across, and then the two halves may be removed separately by means of strong forceps, with less injury to the periosteum than if the bone had been removed entire.

Injury or disease of the *fibula* being comparatively rare, very few observations have been made. M. Ollier, however, remembers the wise counsel that its upper extremity should not be dealt with rashly, on account of its frequent communication with the great synovial cavity of the knee-joint and the consequent risks.

Resections of one or more bones of the *tarsus* are operations which depend for their success more on the nature of the disease for which they are performed than on any little specialties in the nature of the operative procedure. Thus the most skilfully performed periosteal resection, even by M. Ollier, if for scrofulous disease, will almost certainly result in failure from recurrence of the disease, while if it is only for some local inflammation or necrosis that the operation be undertaken, it matters comparatively little whether periosteum be left or removed, whether M. Sedillot performs his "évidement," M. Ollier his "resection sous periosteal," or whether, in less fine terms, we simply make our incision over the spot, remove the exfoliation, or gouge out the carious cavity. M. Ollier naturally enough does not homologate this opinion, but strongly supports his own subperiosteal resections, and relates cases in which after complete removal very good new heels were formed, to which the *tendo Achillis* preserved its attachment. Besides the *os calcis*, the only other bone of the foot which is of much

¹ E.g., case of excision of elbow-joint and whole ulna, by Dr Williamson. Williamson's Military Surgery, p. 228.

interest from this point of view, is the first metatarsal. It is often diseased ; it is of the very greatest importance in maintaining the form and giving spring to the foot ; hence efforts may be made to save it, which would be hardly needed for any of the other metatarsals. The risk in all cases of removal of the first metatarsal, either in whole or part, is that the great toe is drawn upwards on the foot and rendered useless (we have seen one case in which it was placed on a level with the centre of the second metatarsal) ; to avoid this, M. Ollier figures an ingenious apparatus, in which by means of little india-rubber " toe-stalls " attached to cords and pulleys, the toes can be kept in their own position till consolidation has taken place.

We have left ourselves but little space to analyze M. Ollier's accounts of subperiosteal resections of the great joints. The principle is—

" The complete preservation of a periosteo-capsular flap,—that is to say, a fibrous canal, which lies between and unites the ends of the resected bones,—capsular ligament in its centre, periosteal at each end. At the periosteal portions the bones are reproduced, the capsular portion remains fibrous, and the joint is restored.—P. 298. . . . Once we reserved the 'sub-capsulo-periosteal resections' for these cases only which had recently suppurated, or were the result of accident, fearing, in chronic cases, to leave in the wound the fungating remains of the old joint. Clinical experience has shown that our fears were exaggerated, and that in all cases of resection it is an advantage to retain the periosteo-capsular canal. In destroying the fungous remains and altering their character by the use of the actual cautery, or of nitrate of silver at the time, and afterwards by stimulating dressings, the capsule may be placed in a condition favourable to cicatrization."—Pp. 300, 301.

M. Ollier owns that it may be urged against his more difficult and complicated method of treatment, that most excellent results have been obtained without it, by Syme, Textor, Langenbeck, and others. Owning this, he hopes that by his method the good results, which have hitherto only been exceptions, may become the rule ; and points out that these surgeons who have been so successful are the very men who have always shown greatest knowledge of, and confidence in the powers of the periosteum. Page 301, note.

The sections on the method of operating, on the importance of after-treatment, and the choice of suitable cases, are very interesting.

Resection of the shoulder-joint does not vary much from the ordinary method which for many years has been practised here. Instead of cutting the various tendons close to the bone, M. Ollier scrapes or shoves them off with the "detache-tendon." We never remove the capsule, and he generally contents himself with gouging the glenoid cavity. His results seem in no respect superior to the ones with which we are familiar.

The notice of excision of the *elbow-joint* is very long and full of interesting observations. M. Ollier recommends two different incisions, according to the case. In disease, he gains access by one zigzag incision along the outer side of the humerus, then slanting

across to the posterior border of the ulna, and following it to the required length. For ankylosis, he uses a double incision, one at each side of the olecranon, the external one being the largest. We cannot see the least advantage which this has over the longitudinal one.

Of twelve cases of subperiosteal resection of the elbow, performed at Lyons, three died,—a very large percentage; the numbers are too small for any great stress to be laid on them.

Some of his results are most excellent, both as to the shape of the joint, range of movements, size of limb, and power; but we believe this is due more to the sensible after-treatment than to any specialty in the method of operating. And when speaking of results, he still quotes Mr Syme's well-known case of the railway-guard as the most remarkable which he has been able to discover. M. Ollier has never practised excision of the *wrist* on the living body, and he is by no means up to the latest mark even in his directions for the performance of the operation on the dead body. He ends his account of resections of the upper extremity by giving a case in which he excised with very fair result the phalangeal joint of the thumb in a man aged fifty-eight.

M. Ollier has never practised *excision of the hip-joint* in the living body, chiefly from the sufficiently well-grounded fear of the special dangers of such an operation in a great hospital. He gives a full description of the method of subperiosteal resection. The same absence of clinical facts diminishes the value of the proposals which M. Ollier throws out guardedly on the possibility of aiming at a mobile articulation in *excision of the knee-joint*, by the preservation of periosteum along with the capsule of the joint. Of three cases on which M. Ollier performed excision of the joint in the usual method, all died from causes immediately dependent on the bad hygiene; and this want of success has naturally discouraged further attempt. Judging from the cases reported, subperiosteal resection of the *ankle-joint* seems to be a most successful operation, specially so in traumatic cases. Langenbeck's series of five (now so well known) are detailed, and a few more by M. Ollier himself are well worthy of perusal.

Chapter XIII. contains an account of some accidents after fracture due to an excess or deficiency of callus. A most ingenious operation is described by which M. Ollier freed the radial nerve from its imprisonment in a mass of callus, and by this means cured a paralysis which had been caused by pressure on the nerve. The subject of treatment of false joint is fully discussed. A case is given in which a false joint, which had not been improved by four months' confinement, was cured by various perforations of the fibrous band of union, aided by subcutaneous scraping and elevation of the periosteum, as was lately practised in an interesting case by Dr John Duncan of Edinburgh.

Another case in which a false joint of the femur was operated on,

by its death from pyæmia, adds another to the long list which prove the exceeding danger of compound fractures of the femur in great hospitals.

Chapter XIV. returns to the author's favourite subject of transplantation of bone. While he has no clinical facts of his own to add to the experiments on animals in the first volume, he quotes the very curious attempt made by Percy to transplant a piece of beef-bone to fill up a vacancy left between the fragments of a fracture of the tibia with loss of substance. This experiment failed. Though he fears it is a myth, M. Ollier quotes an amusing account of a successful case, to show that the idea of such transplantations was no new thing even in Percy's day. It is taken from the *Observationes Medico-Chirurgicales* of Job à Meckrem, which date as far back as 1670.

"An ecclesiastic, named Krauwinkel, told him that, being in Russia, an engineer of that nation received a blow on the head from the sabre of a Tartar, which separated entirely a large piece of the hairy scalp with a corresponding portion of skull, the detached fragment being left on the field of battle. The surgeon, to close the orifice, detached from the skull of a dog, killed for the purpose, a portion of bone of the same size and shape as the piece that was deficient, and managed it so well that the wounded man was perfectly cured. But our gentleman, in the fulness of his joy, told how he had been cured, and at once the thunders of the church were levelled at him. To obtain re-entrance into the communion of the faithful, he had to strip himself of the unclean spoils of the hound, although already firmly consolidated, and submit to a treatment more consistent with the character of a Christian."

M. Ollier gives his views of the essentials to a successful transplantation of bone, so far as is known, as follows:—

"It is necessary that the bony flaps should be taken from the same subject, or from one of the same species. The age of the animal is not of vital importance, but the flaps reunite best in young animals. In old subjects it is better to use a flap cut from a young one. The younger the tissue is, and the more soft elements (periosteum and medulla) it contains, the more suitable it is to form a flap."

Chapter XV. is on osteoplasty. "Osteoplasty is an operation which has for its aim the restoration of the form of organs by means of bony tissue. It is an autoplastic operation which differs from ordinary ones in consisting of flaps which either already contain bone or which are destined eventually to ossify."

The latter variety of operation will probably be in the end found the more useful and universally applicable. We cannot do more than merely mention this interesting chapter. It contains directions for operations chiefly in cases of deficiency of the nose and of cleft palate. Langenbeck's great success in the treatment of the latter deformity, by raising periosteal flaps and approximating them in the middle line, receives full justice.

Chapter XVI., and last, describes operations which M. Ollier calls "temporary resections" of the bones of the nose and face, undertaken for the purpose of giving free access to deep-seated fibrous polypi. The results were good and without deformity. It

concludes with a proposal that in amputation an attempt should be made to save a flap of periosteum, which may be left adherent to the soft parts, and with them be folded over the face of the cut end of the bone. One would be afraid that such a flap might give rise to annoyance by irregular or excessive osseous deposits.

Some additional notes and a fairly copious table of contents finish the volume and the work. Our very full analysis of its contents has left little space, and, perhaps, little need for criticism. This whole book shows that it is the work of an enthusiast, an able indomitable worker, an experimenter who knows not what weariness or satiety mean, an observer who can group what he has read and what he has seen into a system. The perfect clearness, and almost epigrammatic smartness of the style, make the book very easy and pleasant to read. Without denying that here and there M. Ollier is wrong, and still oftener that his enthusiasm may have made him too sanguine, there is no doubt, that in this, his life work, the great Lyons surgeon has set his mark on the conservative surgery of the nineteenth century, and thrown out hints and established principles which may possibly, in their adoption and elaboration, make the fame of half-a-dozen younger surgeons.

The Journal of Anatomy and Physiology. Conducted by G. M. HUMPHRY, M.D., F.R.S., Professor of Anatomy in the University of Cambridge; ALFRED NEWTON, M.A., F.L.S., Professor of Zoology and Comparative Anatomy in the University of Cambridge; WILLIAM TURNER, M.B., F.R.S.E., Professor of Anatomy in the University of Edinburgh; E. PERCEVAL WRIGHT, M.D., F.L.S., Lecturer on Zoology in the University of Dublin; and J. W. CLARK, M.A., late Fellow of Trinity College, Cambridge, Superintendent of the University Museums of Zoology and Comparative Anatomy. No. II., May 1867. Macmillan and Co., London and Cambridge.

THAT a Journal of Anatomy and Physiology in our country is required, no one acquainted with the rapid progress of these sciences, and with the example of continental nations will dispute. It will be remembered that, about fifteen years ago, the late Professor Goodsir commenced a periodical of this description,—the *Annals of Anatomy and Physiology*,—which his other laborious occupations prevented him from carrying on. The journal now before us, under a combination of distinguished editors, which will ensure the co-operation of our principal Universities, presents conditions peculiarly favourable for success. The two numbers which have appeared contain important contributions of a high order of merit, sufficient to establish the character of the journal as a scientific periodical of the first class. Among the original

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ART. I.—*Description of two New Algoid Vegetations, one of which appears to be the Specific Cause of Syphilis, and the other of Gonorrhœa.* By J. H. SALISBURY, M. D. (With sixteen illustrations.)

I. *Syphilis.*—The specific cause of syphilis attacks especially those histological elements, the characteristic, proximate, organic principle of which is either gelatine, osteine, or chondrin. These are connective tissue proper, bone, and cartilage. It first attacks the connective tissue at the points of inoculation, and next the connective tissue of the lymphatic glands, in the vicinity of the primary lesion. After the primary sore or sores have healed, the specific cause may remain, apparently, dormant in the system, for from a few days to some months, or even years. It may then show itself in blotches over a part or the whole surface of the body, resulting frequently in hard swellings of the connective tissue,¹ which may or may not be followed by a breaking down of the histological elements involved. Sooner or later the poison may attack the periosteal and perichondrial membranes, especially in those parts of the body where they are covered but thinly by the softer tissues. From the periosteal and perichondrial membranes the lesions extend to bone and cartilage.

The primary sores represent the primary disease. The lesions of the connective tissue of the lymphatic glands and loose connective tissue of the body, which accompany or immediately follow the primary sore, indicate that the poison has permeated the system. These may be called the primary constitutional disturbances, to distinguish them from the primary local lesions at the point or points of inoculation.

¹ These swellings are caused by a too rapid development of the glue tissue cells, excited by the active growth among them of the *Crypta syphilitica*.

but by an act of secretion excited by the impression made upon the mucous membrane. We are not justified, therefore, in assuming, with Longet, that the absorption of solutions of greater density than the blood is always in opposition to the laws of endosmosis.

"The imbibition of the colouring matter of the bile by the coats of the gall-bladder after death, while nothing of the kind takes place during life, is not due to the absence of vital action. During life, the circulation in the mucous membrane of this reservoir would readily remove the few particles of colouring matter which might penetrate from the bile, and of course there is no time for any colouration to take place.

"In treating of the variations and modifications of absorption, we noted an apparent elective power in the mucous membrane of some portions of the alimentary canal. This is illustrated in the failure of the mucous membrane to absorb the woorara and various of the animal poisons, which, as a rule, are only effective when introduced into a wound or injected into the areolar tissue. The separation of various soluble substances by the process known as dialysis may throw some light upon this subject, but as yet we have no facts which offer a satisfactory explanation of this phenomenon. Certain of these phenomena which show an apparent elective power in absorbing membranes are probably due to a cell-action resembling secretion; for all these surfaces are covered with epithelium, which must be penetrated before the fluids can get to the blood-vessels. But even with regard to the selection of materials from the blood to form secretions, very little of a definite character is known.

"Those who believe that absorption is often modified by vital action offer this in explanation of the important influence of the nervous system on this function. Precisely how the nervous system affects absorption, in all instances, it is impossible in the present state of our knowledge to determine; but modifications are frequently effected through the sympathetic system. These nerves, as is well known, are capable of producing important local changes in the circulation, and can even temporarily arrest the capillary circulation in some parts; and it is in this way that many of the variations in absorption may be produced."

With these references to a few of the more important points of its contents, we take leave of Dr. Flint's book. The next two volumes of the series are to be devoted to Secretion and Excretion, Nutrition, Movements, &c., the Nervous System and Generation. If these two volumes should equal the first in excellence of material and style, we feel convinced that Dr. Flint's work, as a whole, will take a high position among modern standard works on physiology.

J. A. M.

ART. XIX.—*Traité Expérimental et Clinique de la Régénération des Os et de la Production Artificielle du Tissu Osseux.* Par L. OLLIER, Chirurgien en chef de l'Hôtel-Dieu de Lyon; avec 9 planches gravées sur cuivre et 45 figures intercalées dans le texte. Tome premier, Partie Expérimentale; Tome seconde, Partie Clinique. 2 vols. in-8 maj., pp. xx. 443, 531. Paris: Victor Massonet Fils, 1867.

Experimental and Clinical Treatise on the Regeneration of Bones, and on the Artificial Production of Bony Tissue. By L. OLLIER, Surgeon-in-chief to the Hôtel-Dieu of Lyons; with plates and woodcuts. Two volumes, royal 8vo.

THE name of Ollier is already, doubtless, well known to our readers, as indeed it must be to all who are interested in the progress of surgical

pathology, from the very remarkable and admirable papers which he has contributed during the last ten years to the "*Gazette Hebdomadaire de Médecine et de Chirurgie*," the "*Journal de la Physiologie*" (Brown-Séquard's), and other medical periodicals of Paris and Lyons. The subjects which during this time have received his special attention have been the regeneration of bone through the agency of the periosteum, the reconstruction of joints (after articular resections), and what may, perhaps, best be designated as "periosteal osteoplasty," and the production of bony grafts. In the prosecution of his investigations, M. Ollier tells us, he has performed a large number of experiments on the lower animals, and, by his position in the Hôtel-Dieu of Lyons, has, since 1860, been enabled to test and verify the conclusions he had derived from experimentation, by careful clinical observation of a great many cases of bone lesion in the human subject. The fruits of this ten years' cultivation of the wide field laid open before him, M. Ollier has recently communicated to the public in the work contained in the two goodly volumes which are now upon our table.

It is our intention to present our readers with a brief analysis of this result of M. Ollier's labours, and in doing so to examine somewhat critically the applicability of his views to the civil and military practice of surgery.

M. Ollier's work is most appropriately dedicated (as an important contribution to physiological surgery) to MM. Claude Bernard and Velpéau, who may well be considered representative men in the departments of science which they have respectively so brilliantly illustrated.

An interesting preface of twelve pages furnishes some account of the method which our author has pursued in the conduct of his studies, and must serve to convince the reader, that whatever view he may take of the conclusions to which these studies have given rise, the conclusions themselves have been, at all events, carefully and honestly deduced.

The work itself is opened with an introduction, divided into two portions; the first treating "of experimentation upon the bony system, from the point of view of human surgery," and the second giving an "historical sketch of the theories on the regeneration of bones, and of experiments on the osseous system."

The author begins by pointing out the importance and even necessity of experimentation upon the lower animals for the correct study and appreciation of surgery as applied to the bones. The exact ideas which we now possess with regard to the normal nutrition of the skeleton, and the origin of its morbid alterations, date back for not more than a century, and are founded, we are told, on Duhamel's celebrated experiments. Our theories of the formation of callus, and of the reparation of bones in cases of necrosis, were, previous to that period, without any real scientific value, and those points upon which uncertainty still exists, are precisely those which need to be illustrated by further and more accurate experiments than have yet been made. Malgaigne is referred to as the surgeon of modern times who has, perhaps, most thoroughly appreciated the importance of experimental observation; and his classical works on "Fractures and Luxations," and on "Surgical Anatomy and Experimental Surgery," are instanced as exhibiting at almost every page the great advantages which he himself had derived from this method of study. The illustrious names of Hunter and Bichat, with, in later times, Chaussier, Béclard, Dupuytren, Breschet, Cooper, Travers, Heine, Amussat, and

Jobert, may be enumerated in the same category, as surgeons who have recognized the necessary dependence of practical surgery upon the carefully conducted study of experimental physiology.

At the end of the last century and at the beginning of this, when the modern practice of resection first came into notice through the labours of White, Moreau, and others, the question of the reproduction of bone was argued, but without any practical result, for affirmative were simply balanced against negative cases, without any attempt to explain why in certain instances a true bony reproduction took place, which in others was entirely deficient. The fact was, that those cases where the parts removed were regenerated, were cases of necrosis, where the periosteum had been spontaneously separated by the diseased action; while in healthy bones it was almost if not quite impossible, by the operative procedures then employed in resections, not to destroy the periosteum, and thereby totally prevent any bony reproduction whatever.

While there are still numerous points in the process of development of bone which require further elucidation, the microscope has served to throw light upon other points which were long eagerly, though blindly debated. "In following the modifications of the cells of the periosteum, it has been seen that the transformation of this membrane into bone was a reality. Accordingly, upon this point there is no diversity between Virchow and Duhamel, but simple variations of language, explicable by the difference of times."

The questions most urgently calling for investigation at present, in view of the existing state of surgery, are that of the regeneration of bones after resections or total excisions, and that of periosteal and osseous osteoplasty.

Besides these, the general theory of the growth of bones healthy and diseased, resected and reproduced, and that of the healing of these organs after fractures or after lesions which affect the various elements of their tissue, demand special development.

These matters can only be properly studied by careful and painstaking physiological and pathological experimentation. Our author quite appreciates the absolute necessity of *accurate* and *oft-repeated* experiments: "The history of Experimental Physiology is encumbered by unproductiveness, and nothing has so much retarded the progress of this science at certain periods, as defective experiments, announced with *éclat* and sustained by a great name." Not only must allowance be made, in experiments upon normal nutrition, for the new and disturbing element introduced by the irritation of the experimental procedure itself, but account must also be made of the effect of a change in one tissue upon the tissues adjoining—something like what the older writers would have called a "sympathy by contiguity." Thus, there is demonstrable a sort of action by presence on the part of bone, and especially of its periosteum, which gives rise to a special tendency to ossification in all the connective tissues in the neighbourhood.

M. Ollier's experiments have been made upon dogs, cats, rabbits, sheep, pigeons, chickens, etc. Bone is more easily reproduced by the periosteum in the lower animals than in man, but it does not follow that it should be more easily reproduced in those which are lowest in the scale of creation, than in those whose structure more nearly approaches that of the human being. Thus "transplantations of periosteum succeed much better in the dog and cat than in the sheep and calf, and yet the two latter animals are considered further removed from man."

Our author well states the limits of the applicability of experimental physiology to surgery :—

"It must not be thought that an operation is sure to succeed in man merely from the fact that it is perfectly tolerated by certain animals. Experimental physiology does indeed furnish the surgeon with very legitimate motives of action, but clinical observation alone must exercise the final judgment. It is above all in another point of view that the utility of experiments should be considered; their principal advantage is to separate, to decompose complex facts which can only be unravelled by isolating their elements. We seek simple facts, and we exercise our ingenuity in reproducing them. We then decompose complex facts in order to arrive at their interpretation. By proceeding thus, we find laws which are applicable to all animals that have the same conformation, and which consequently are applicable to man."

The experiments of Duhamel, Troja, Heine, Flourens, and others, brilliant and satisfactory as they were, did not succeed in establishing the doctrine of the regeneration of bone from periosteum, as an acknowledged truth, with either physiologists or surgeons. It was not until the idea occurred to our author of experimenting by the *transplantation* of periosteum, that the demonstration became irresistible, and the conclusion not to be gainsaid.

These preliminary considerations appropriately lead the way to the second portion of M. Ollier's introduction, which gives a brief historical sketch of the theories and observations of days preceding his own.

We shall not attempt to follow our author through this part of his subject, though it is full of interest, and in its manner of treatment shows wide research and careful and conscientious analysis. We may simply observe that M. Ollier divides the history of his subject into two periods, that of pure observation, from the time of Hippocrates and the earliest medical writers to the days of Havers (the describer of the so-called Haversian canals), and the second or experimental period, beginning with Duhamel (1739-1757), and coming down to the present time. That bone can be reproduced and that the periosteum is capable of reproducing it, have been repeatedly demonstrated by both experiment and clinical observation, and yet the practice of surgery, as regards resections, has been unmodified by these demonstrations until very recently. In fact, as remarked by our author, there are still, as at the beginning of the century, two classes of adversaries to be contended with; those who admit that bone may be regenerated, but who think the periosteum unnecessary for the purpose; and those who deny the possibility of osseous reproduction, even though the periosteum should have been most carefully preserved.

From motives of convenience, M. Ollier has divided his work into two portions, the first experimental, the second practical or clinical. The first part (occupying with the introduction, already considered, the first volume) contains fourteen chapters, and of these we shall now endeavour to furnish our readers with a short but sufficient analysis.

Every bone is formed of three essential constituents, viz., periosteum, marrow, and bony structure proper; to these may be added a fourth, cartilage, which, however, in the case of a great many bones, acts a part which is only temporary. These several substances are in variable proportion, according to the kind of bone and its period of development. Physiologically and pathologically they are intimately united, though each has distinct functions, whether in the normal development of bone or in the various morbid processes to which it may be subjected. To ascertain, therefore, their relative share in the complex phenomena of

normal and accidental ossification, it is necessary to make each the subject of special study in its individual power of action.

To demonstrate the possibility of the periosteum alone giving rise to a new formation of bone, M. Ollier describes three series of experiments which he has performed, by transplanting portions of this membrane to a greater or less distance from their natural position. In the first series, he dissected up a flap of periosteum, having first separated it from its muscular connections, and spread it out in a kind of nest previously prepared in the surrounding soft tissues.

One extremity of the periosteal flap was permitted to retain its natural attachments, while the other was secured in its new position by a single suture. The wound then being carefully closed, immediate union was generally obtained, and the animal being sacrificed at periods varying from six weeks to three months, well-marked new formations of true bone were found to have been developed from the transplanted membrane, the size and shape of the new portions corresponding with the size of the periosteal flaps, and the positions in which they had been placed. These experiments were performed on rabbits, cats, and dogs, success in the latter being more difficult to obtain, on account of the proneness to suppuration generally observed in wounds of that animal. The bone generally employed was, from motives of convenience, the tibia; though a perfectly successful result was secured in one instance from the periosteum of the skull in a cat.

A second series of experiments was then instituted, in which, when the process of ossification in the transplanted flap had already begun, its remaining attachment to the main body of periosteum was severed. In these experiments it was found that the process of bone formation went on just as well after as before these connections had been destroyed; and it was thus shown "that the production of bone goes on and is completed by the periosteum's own power of action, when the flap has already contracted adhesions with the tissue in the midst of which it is placed."

The third series of experiments carries the demonstration still further, and shows that even the temporary continuity with the main body of periosteum is unnecessary. In these experiments the periosteal flap, having been bared and dissected, as in the previous series, was absolutely removed from all its attachments and transplanted or grafted into a widely distant part of the animal's body. By this plan true and distinct bones, with true periosteal coverings, and containing marrow cavities and marrow, were developed wherever the graft could be inserted. Thus a strip of periosteum from the tibia of a rabbit produced a bone beneath the scalp; the new formation, at certain points, being as thick as the diaphysis of the ulna had been at the time of the experiment.

As was before observed, these experiments are not equally successful with all animals. They almost always fail with those of the ruminant class on account of suppuration of the wound, while in the dog, cat, and rabbit, primary union and success can generally be obtained.

"It is only by direct experimentation, in every case, that we can ascertain the greater or less aptitude of any particular animal for the periosteal graft. Accordingly we do not know as yet whether the transplantation of periosteum to a distance would produce osseous tissue in man, but everything leads us to believe that it would, provided that union by the first intention could be obtained, and that a young and healthy subject should be chosen for the experiment."

In old animals, the periosteum, though it may contract adhesions in its new position, will remain fibrous without any development of bone. Other causes which may hinder or prevent the success of the experiment are carelessness in the operative procedure, accidents to the wound after the operation, want of care in removing foreign bodies from the wound, or a bad state of health in the subject selected for experiment. While advanced age will interfere with the production of bone from periosteal grafts, too great youth, on the other hand, may produce likewise a deleterious effect, the transplanted portion itself becoming absorbed, as was found in three experiments made on dogs within ten or fifteen days after birth.

Again there is a difference as regards the bone from which the periosteal graft is derived. As a rule that obtained from the long, answers better than that taken from the flat bones, and in the former the portion nearest the joints does better than that from the centre of the shaft; this is explained by the fact that the periosteum in proximity to the articulations is thicker than at any other portion of the bone.

A curious experiment was performed by M. Ollier, with a view of determining the true function of the *dura mater*; two strips of this membrane, derived from the vault and the base respectively of the cerebral mass of a rabbit six weeks old, were inserted, one into either groin of another rabbit aged two months. Forty-one days later the strip from the convexity of the brain had produced a uniform osseous mass of the dimensions of a grain of wheat, while that from the base, although likewise ossified, was so in little isolated granules, which taken together scarcely equalled a half of the bony mass produced from the first strip. The difference is probably explicable by the very close adherence of the *dura mater* to the base of the skull, which renders its separation in that locality more difficult, and increases the probability of portions being left behind which are of the external layer, and that which is best adapted to the regeneration of bone.

In adult rabbits, no new development of bone was obtained, but a remarkable circumstance is that in all cases more bone was produced by the transplantation of *dura mater* than of *pericranium*.

Having demonstrated that the periosteum has in itself the property of producing true bony tissue, our author next proceeds to inquire whether, in the discharge of this function, the periosteum acts as a whole, or whether the osteogenetic power is an attribute of any particular portion of its structure. The following brief account of the microscopic appearances of the periosteum, we condense from M. Ollier's description:—

"There is first (going from without inwards) a thin layer of loose connective tissue, containing fat cells; but this layer does not, strictly speaking, belong to the periosteum; it results from the imperfect separation of the surrounding areolar tissue. This layer having been removed, we find a tissue of fibrous appearance, closely knit, and formed of very small corpuscles of connective tissue, united by an intercellular substance in the form of fine undulating fibres. This can be divided by needles into very close bundles, like dense fibrous tissue; it contains numerous elastic fibres. Towards the internal surface of the periosteum the cells become larger, the intercellular substance still retaining its fibrous appearance, and the elastic fibres become more and more numerous. If now the preparation be taken up by its internal or deep surface, elements of entirely different aspect are presented; these are oval or fusiform cells in the midst of a more or less distinct intercellular substance, which is granular or fibroid. Most of these cells have but one nucleus, but a certain number will be found in process of proliferation. Some, even, those which are nearest the bone (seen especially in very young

subjects), have altogether the appearance of the polynucleated cells of the marrow."

This structure is continuous with, and passes gradually into that previously described. This inner layer of the periosteum has been designated by various names, according to the different views of pathologists; thus Kölliker calls it the "blastema of ossification;" Virchow names it the "periosteal layer of proliferation;" while according to Ranzier (*Thèse Inaugurale*, Paris, 1865), upon whose views our author is disposed to look with much favour, it is formed of true marrow cells, which serve directly for the growth of the bone in thickness.

By the same process of physiological analysis which M. Ollier adopted in his previous experiments, he now proceeds to ascertain which portion of the periosteum is that which is concerned in the formation of bone; and he clearly demonstrates, (1) that the periosteum, deprived of its inner layer, is no longer possessed of osteogenetic powers, and (2) that portions, no matter how minute, of this inner layer, when transplanted, can and do produce particles of new bone, and that consequently this layer is entitled to the name which he proposes for it, of the "osteogenetic layer of the periosteum."

It is, however, to be observed that the external layer alone, after a long time (six months in one case), does regain partially the properties of the periosteum before being deprived of its osteogenetic portion, and a real, though very imperfect formation of new bone, may thus be obtained. It is also to be observed, that in detaching the periosteum from the bone, a part of the osteogenetic layer is left adhering to the latter; this performs an important part in the development of a new periosteum, as is not unfrequently seen in scalp wounds and other injuries of like nature.

Having established that the periosteum has the property, when transplanted, of giving rise to the development of new bone, our author next proceeds to demonstrate the complementary proposition that bone cannot be produced by the transplantation of any other analogous fibrous tissue. Experiments were made with tendons, aponeuroses, and fibrous capsules, and with the single exception of the *dura mater* (before referred to), the osteogenetic power was found to be limited to the periosteal, among all the fibrous tissues of the body. In one experiment, made with the tendon-Achillis of a rabbit, an apparent production of bone was observed; but examination with the microscope showed not ossification, but calcification merely; a not very unfrequent result of traumatic irritation of tendinous structure.

The osteogenetic property of the periosteum may then be considered as an established fact; the manner in which that property is exercised is, however, still an open question. The osteoplast or osseous cavity, it is generally conceded, is developed around a previously existing element. The theory of Ranzier, which our author is disposed to adopt, is as follows: there is, first, a dissolution and disappearance of the primitive intercellular substance of the periosteum, the cells themselves being as a consequence set free; these cells are subsequently arranged in concentric layers, and a new intercellular material is developed which finally becomes the true bony substance.

Virchow, as is well known, believes in a direct transformation of the connective tissue corpuscle, with a simultaneous invasion of the intercellular substance; this view, however, as pointed out by Robin (*Journal de l'Anatomie et de la Physiologie*, Sept. 1864), does not account for the

arrangement of the osteoplast in concentric layers. The distinguished editor of the *Journal de l'Anatomie*, himself, explains the development of bone by supposing the existence of a temporary layer of cartilage beneath the periosteum; this he terms "ossification by encroachment," the cartilage being invaded by a calcareous deposit at the moment of its formation. M. Ollier believes the production of cartilage from a transplantation of periosteum to be accidental, and due to an excess of activity in the transplanted portion; but, under any circumstances, the question has lost its importance since Virchow has shown that cartilage and connective tissue are interchangeable equivalents, which can replace each other, and which often proceed from the same source.

There is a limit to the growth of *hetero-topic* bones, or those developed from periosteal grafts. In the first place, as they have no "cartilage of conjunction,"¹ they do not increase in length, and secondly, although the contrary might be supposed *a priori*, they do not grow in thickness commensurately with normal bones in the same subject; the process of ossification ceases, as soon as all the ossifiable elements have been exhausted.

The structure of hetero-topic bone is fundamentally the same as that of normal bone; but it is to be noted that it resembles *very young* bone, more than that which is found in the adult. A very beautiful plate is given, showing the microscopic appearances of the new-formed osseous tissue.

With regard to the osteogenetic layer of the periosteum, at the commencement of his investigations, M. Ollier, influenced by the prevailing histological doctrines of the day, denominated it a subperiosteal blastema; he has since recognized that it is no exudation or amorphous new material, but that it has, in every stage of its development, the same fundamental structure as the rest of the periosteum, of which it is, indeed, but the active and bone-producing part.

M. Ollier's second chapter treats of the *marrow* and of its effects in the formation and nutrition of bones. The majority of the older anatomists supposed the marrow to be inclosed within a delicate but demonstrable membrane, to which they gave the name of medullary membrane, or internal periosteum. Even during the last century, however, the existence of such a membrane was denied by the illustrious Ruyssch, and its non-existence has more recently been clearly proved by the researches of Gossein, Regnault, and others. The external layer of the marrow is, indeed, somewhat different from those more deeply seated; it contains fewer fat-cells, and more of the polynucleated cells to which Robin has given the name of *myéloplaxes*. It is, in fact, of more recent formation than the deeper portions of the marrow, and we are thus led to a view of the true function of this substance in its normal condition. As the bone is formed directly from the periosteum, the marrow is in turn formed from the innermost layers of its surrounding bone, whether by direct proliferation of the osteoplasts, disengaged from their calcareous envelope by liquefaction of the fundamental substance (Virchow), or otherwise, cannot at present be positively determined. The fact is, however, established that the medullary cavity grows at the expense of the inner layers of bone, not by a distension of its osseous envelope, but by a direct process of transformation whereby the inner layers of bone disappear as others are added exteriorly by development from the periosteum. The limits of our

¹ By this term "cartilage of conjunction," M. Ollier designates the temporary cartilage which connects the diaphysis of a bone with its epiphyses.

space will not permit us to go into the experimental details by which these positions are established; suffice it to say, that all of M. Ollier's investigations have been conducted with the same care and scrupulous attention to accuracy that characterized those to which we had occasion to refer, in considering his first chapter.

Though the property of marrow in its normal condition, is, as we have seen, rather antagonistic than analogous to that of the periosteum, yet under certain circumstances, it has itself the power of ossification independently of its surroundings. Marrow, when transplanted, never produces bone; this has been established by M. Ollier by at least fifty distinct experiments. When isolated, however, *in situ*, by means of a metallic tube thrust into the medullary canal, the case is different; under these circumstances, M. Ollier has obtained from the marrow itself a well marked new osseous formation. The marrow is thus seen to differ from the periosteum, in that while the latter normally tends to bone production, the former only does so when its cells are recalled to activity by a certain amount of irritation; nor must this irritation be too great, for if excessive the marrow will break down into pus; there being, in fact, as remarked by Virchow, no tissue more disposed to purulent transformation.

The marrow, unlike the periosteum, is exceedingly sensitive to pain; its sensibility increases in proportion to the nearness of the source of irritation to the nutritive foramen of its containing bone. The marrow is extremely vascular, but, contrary to what might be supposed, its nutritive vessels may be obliterated, without compromising the vitality of the bone. The absorbing powers of the marrow are very great. The injection of ten drops of a concentrated solution of cyanide of potassium has produced death in rabbits in from ten to twenty seconds, the rapidity being proportionate to the proximity of the place of injection to the trunk. The same amount of liquid injected into the liver, the lung, or the peritoneal cavity, did not produce fatal results.

Chapter Third treats of bone tissue proper, studied with regard to its individual activity and its relations with the periosteum and with the marrow. The intimate structure of bone is well described, and the processes of ossification and calcification duly considered, and the differences between them pointed out. The effects on bone of the removal of its periosteum are then considered; as already intimated in chapter first, under favourable circumstances, necrosis will not ensue, but a reproduction of true periosteum will take place. This is accounted for by the fact that a portion of the osteogenetic layer still adheres to the bone, and it is by its proliferation that the new periosteum is formed. That this new material is true periosteum is proved by the experiment of transplantation, by which new bone can be obtained just as from the original periosteum, though in much less quantity. This process cannot, however, be repeated indefinitely, and M. Ollier has never succeeded in procuring bone from the transplantation of periosteum of the third generation. Hence the author's conclusion that "the reproduction of periosteum, indefinite as far as it constitutes a cicatricial membrane, is, on the contrary, very limited as regards its property as an osteogenetic membrane. However real may be the activity of the superficial layer of the bone, this activity is diminished, exhausted, or changed in direction after a first denudation. The new cells are no longer fitted for ossification after they are removed from the bone. Nevertheless, in place, if the irritation continue, they may give rise to osteophytic productions, which may even rise beyond the level of the denuded surface."

A single removal of periosteum does not diminish the thickness of bone, which in young subjects may even become hypertrophied at the point of operation. Successive denudations, however, produce a depression which continues permanently. One curious fact is that bones bared of periosteum increase *in length*; a circumstance only to be explained by the superposition of a formative irritation propagated throughout the entire extent of the bone to the cartilages of conjunction.

If, after removing the periosteum, the bone be thoroughly scraped, so as to destroy any remnant of the osteogenetic layer, the periosteum will in time be reproduced, though more slowly than when that layer is allowed to remain; but the new periosteum will not in this case have the property of reproducing bone when transplanted.

Similarly, when superficial necrosis follows periosteal denudation, a cicatricial membrane will in time be reproduced; but as in the preceding case it will have no true osteogenetic power. The process by which this cicatricial membrane is developed is manifestly by proliferation of the superficial layers of the true bone tissue, and of the medullary matter contained in its canaliculi.

Destruction and removal of the marrow is not necessarily followed by necrosis of the surrounding bone. Under favorable circumstances, a new marrow is very rapidly formed, which, if the irritation continue, may further undergo the process of ossification.

Even the simultaneous removal of both periosteum and marrow, will not always give rise to necrosis; in one experiment of M. Ollier's on a healthy dog three months old, a new periosteum was formed at the end of five weeks, the medullary cavity was filled with a spongy bone tissue rather larger than the portion of marrow removed, and the whole bone itself was considerably hypertrophied.

A section on the chemical composition of bone in its various physiological states concludes the chapter.

Chapter Fourth treats of cartilage and of its part in the process of ossification. A good summary of the respective views of Robin, Kölliker, Virchow, and Müller, is given, and M. Ollier expresses his preference for the theory of the latter, as modified by Ranvier. "The essential characteristic of cartilaginous tissue is the formation of a cavity around a cell, known as the primordial cell. These cavities are disposed in a variable manner in the midst of a fundamental substance, which is hard, resisting, homogeneous, or fibroid." According to the theory which our author adopts, it is the true cartilage cell, or that contained within the cavity above referred to, which becomes the osteoplast, that cavity having been in the first place transformed into medullary tissue. The fundamental substance undergoes calcification, but no true ossification, and finally disappears by liquefaction and absorption.

Cartilage has an interstitial growth, in addition to that which depends on the perichondrium; this membrane shows its resemblance to periosteum by being transformed into the latter, in the case of the temporary cartilages.

M. Ollier has not succeeded in obtaining cartilage by the transplantation of perichondrium; from that derived from the epiphyseal cartilages he has found small bony nodules developed, while that taken from the permanent cartilages has remained fibrous.

Cartilage deprived of its perichondrium does not necessarily perish; when, however, transplanted in this condition, it is incapable of producing a graft.

Cartilage transplanted with its perichondrium may indeed be successfully grafted, and under favourable circumstances may undergo ossification. But the proliferation of its cells is not like that which takes place in the normal development of bone. While the *periosteal graft* produces a new bone of considerable dimensions, that originating from transplanted cartilage is never larger, and generally smaller, than the cartilage itself from which it is developed. An exception is noted in the case of *rats*, in which animals, according to Bert, transplantation gives to cartilage greater activity than if it were allowed to remain in its normal position.

Chapter Fifth treats of traumatic irritation of the different elements of bone, and of other substances of connective tissue formation. The effects of traumatic irritation upon these various parts of the body must be studied, in order to understand the accidental development of anatomical elements in tissues to which they do not normally belong. The general result of any traumatic irritation is the same in all the forms of connective tissue. As pointed out by Virchow (*Cellular Pathology*, Lect. XIV., Chance's edition, pp. 306 *et seq.*), the first effect is the enlargement of the cells, the proliferation of their nuclei and nucleoli, and the formation of new cells; the intercellular substance is for the time being unaffected. Soon, however, there is a perceptible tumefaction and change of colour in the intercellular substance, corresponding with its diminished transparency and the development of new vessels in its interior.

The rapidity with which these changes occur varies very much according to the tissue affected. In the deep (osteogenetic) layer of the periosteum, and in the marrow, where the intercellular substance is loose and unresisting, these modifications take place more quickly than in the fibrous and cartilaginous tissues where the intercellular substance is more dense. The process is still slower in the osseous elements, and almost totally inappreciable in the completely formed adult bone.

If the irritation be but slight, a gradual return to the normal condition may occur; or the process of change may be arrested, without, however, any retrogression, and there will then remain chronic induration and persistent increase of volume in the part affected. It is under these circumstances that the intercellular substance becomes sclerotized, and calcification or even true ossification may take place in tissues which normally do not tend to the production of bone. If the irritation be excessive, and especially if the tissue affected be rich in cells, a purulent transformation may occur, and *suppuration* will ensue; or before this stage is reached, a smaller or larger portion of the tissue concerned may die, and *sloughing* or *necrosis* will precede the formation of pus. This is particularly apt to happen in the case of bone, which is predisposed to a loss of vitality from its capillaries being inclosed in narrow and inextensible channels.

Under other circumstances, a prolonged chronic irritation may bring about secondarily a retrograde metamorphosis, giving rise to granular or fatty degeneration. In these cases there is a gradual absorption or disappearance of the tissue affected, the intercellular substance seeming to melt away, while the cells become successively obliterated.

Of course it is not M. Ollier's intention in his book, nor is it ours in this review, to furnish a complete account of the pathology and processes of inflammation; but the preceding very brief sketch has seemed necessary as a preliminary to the proper understanding of the remarks that are to follow upon osteitis and its terminations.

Direct irritation of the periosteum is very apt to be followed by suppu-

ration ; but irritation transmitted either from the bone or from the surrounding soft tissues, excites the osteogenetic powers of the periosteum to fresh activity and a new production of bone is the result. In old bones this activity is more readily excited than in those of young persons. It is upon these facts, we may observe, that greatly depend the success of any measures for the cure of ununited fractures. The periosteum must be handled very delicately, or the operation itself, by exciting suppuration, will forbid the hope of success. We can understand too, from the above considerations, the occasional success of blisters in cases of bony non-union. The irritation being transmitted indirectly to the periosteum excites its osteogenetic property, without producing suppuration, and a cure is thus sometimes brought about. One valuable hint given by our author in this place, is that before operating on the periosteum of an old subject, it should, in the first place, be rejuvenated, as it were, by repeated slight or indirect irritations. Its vitality may thus be preserved, when if dissected from the bone without such previous preparation, it would have been very apt to become gangrenous, or at best to remain fibrous without any attempt at bone formation.

Irritation of the marrow may, as before observed, cause ossification of that structure, though more apt to produce suppuration. Irritation of the marrow will however be frequently transmitted to the periosteum and give rise there to a new bone formation, even more voluminous than would be produced by irritation of the periosteum itself. A very curious result is occasionally observed ; the irritation of the marrow may cause suppuration of that substance, the bone be completely transformed into a new medullary tissue, while a voluminous formation of fresh bone is developed beneath the periosteum, the bulk of the whole being double what it was before the institution of the experiment. Similar phenomena are sometimes met with in cases of osteitis in the human being, and especially in children. M. Ollier has seen almost complete medullization of the phalanges, without the least necrosis, brought about in the short space of twenty days, by an attack of acute osteitis (*acute caries* of Ribes). The same thing he has observed in the case of the tibia of a youth of fifteen years ; in this instance, however, slight necrosis had occurred at some points, and the disease had lasted two months.

Traumatic irritation of the bone itself may produce an immediate increase in the number of osteoplasts, or, on the other hand, may cause a hyperplasia of the marrow cells in the interior of the Haversian canals. In the latter case the process may continue by an absorption of the bony substance, with rarefaction and subsequent suppuration of the parts previously medullized. Or if the irritation cease before this effect is produced, the process of decalcification may be arrested and the formation of osteoplasts be resumed. This may even go so far as to result in a veritable eburnation, in this case the cure of the inflammation, or it may, as before observed, be the primary effect of a chronic, slow, and long-continued irritation.

Irritation of one of the elements of bone is always transmitted more or less to the others, and is always more or less diffused beyond the point originally affected. As a result, the same bone may present all degrees and varieties of inflammation. In one part there may be undue medullization—in another, eburnation ; here, suppuration and necrosis—there, an exostosis, or ossification of the marrow. The irritation (especially in the young) may be transmitted to the cartilages of conjunction, and by

exciting fresh energy in the proliferation of their ossifiable elements, the length of the bone may be considerably increased. Thus osteitis affecting the diaphysis of a long bone may make the limb affected longer than the healthy limb of the other side of the body, a fact not unfrequently observed in the human subject. Osseous hypertrophy often follows upon irritation of the surrounding soft tissues; this is constantly seen in cases of old ulceration of the leg. Pressure may produce hypertrophy, as in the exostoses accompanying corns; or it may produce exactly the opposite effect, as in the formation of new joints after unreduced luxations.

"The law of accidental ossification is not yet well understood." The long continued use of a tube after the operation of tracheotomy has produced ossification of the tracheal rings; wounds and especially fractures of the costal cartilages are constantly followed by peripheral ossification of the perichondrium; on the other hand, the nasal and auricular cartilages are almost never the seat of bone formation. A curious *action by presence* on the part of the periosteum and other elements of bone is certain, but inexplicable; the same tissues which around an intermuscular abscess become indurated merely, in the neighbourhood of a suppurating periostitis, become positively ossified.

Inflammation does not affect the bone cells proper, except secondarily; its first effects are produced upon the marrow cells, the osteogenetic layer of the periosteum, and the contents of the Haversian canals. The only positive changes that can be recognized in the bone cells themselves, are those which are necro-biotic, the fatty and granular degenerations: these, however, seem sometimes to exist as a primary diathesis, and in such cases a frank traumatic irritation may sometimes serve to bring about a cure.

Necrosis is universally the result of *osteitis*; the capillaries of the Haversian canals become, as it were, strangulated against the bony walls which surround them, and arrested circulation, and death of the part deprived of blood is the consequence. Some interesting experiments are narrated, touching upon the artificial production of necrosis, which want of space compels us to pass over. Our author defines *sequestrum* as a portion of bone separated, but not necessarily entirely dead: in fact, as he remarks, the majority of sequestra extracted by surgeons are vascular in at least a portion of their extent. It is by the absorption or medullization, which goes on in this still vascular and living portion, that sequestra are finally spontaneously separated from the bones to which they have been attached. Bone that is actually dead is not changed by contact with the living tissues; our author in this point confirms the views of Mr. Gulliver, published in the *Medico-Chirurgical Transactions* for 1838. With regard to the term *insensible exfoliation*, our author very properly denies its applicability to the *absorption* of inflamed bone, and restricts its use to those cases where there is an actual throwing off of bony particles, minute though those particles may be. The recent experiments of Savory and Gmelin, on the absorption of sequestra, are referred to in a note; the observations of the English writer showing that *pressure* was the cause of the absorption, when met with.

Chapter Sixth gives us a very excellent account of the process of repair in bone wounds, and of the formation of callus. The reader who has followed M. Ollier through the preceding portions of the volume, will now be able to clearly understand this, which, as generally taught, is one of the most obscure and unsatisfactory subjects in the whole range

of surgical pathology. We would gladly transcribe for our readers a considerable part of this most valuable chapter, but the space already consumed in our analysis of what has gone before, and which was absolutely essential to a comprehension of the rest, warns us to forego that pleasure, and to content ourselves with very brief extracts.

The simplest form of fracture, and that in which the process of repair should, therefore, be first studied, is where the periosteum is not injured; in fact a subperiosteal fracture. Provided the bone be kept at rest, the only external phenomenon during the cure, is a slight tumefaction of the periosteum. This swelling is due to a hyperplasia of the deep or osteogenetic layer. At the same time the marrow becomes indurated, and generally undergoes ossification at the seat of fracture. The bone tissue itself remains ununited for a much longer time; it is only by a secondary process, as seen in chapters third and fifth, that it becomes fused with the new formations without and within, and that finally the solution of continuity is definitely repaired. Thus we see that the whole process of healing after fractures, the formation of the "provisional callus," so-called, and the various phenomena which all students find so complicated and so mysterious, are resolved into a perfectly simple and natural course of events, which is in fact nothing but an exaggeration of the process which is constantly going on in the normal growth and maintenance of bone tissue. This exaggeration is due simply and solely to the traumatic irritation. There is no mysterious organization of a previously exuded juice, no development of blastema or of exudation corpuscles, no transformation of blood clots or of supposititious lymph. There is no new process brought into action; nothing but a *traumatic excitation of the ordinary bone producing functions of the periosteum and other elements of bone.*

In fractures with great displacement, shortening, and overlapping of fragments, the periosteum is still almost never entirely broken across; the broken extremities of bone penetrate its sheath above and below, and the periosteum still serves to unite them by a kind of bridge passing obliquely between them. This periosteal bridge, in the process of healing, forms the bond of bony union. The osseous mass which is hence developed often exceeds in thickness the shaft of the original bone. A narrow cavity is gradually formed in its interior, which may finally communicate with those of the upper and lower fragments respectively; and the projecting extremities of these becoming absorbed and rounded off, more or less quickly, according to the age of the bone, the continuity and form of the osseous cylinder may in time be measurably restored.

In compound fractures the process of repair is the same; but it does not begin until the traumatic inflammation has subsided, and until suppuration has been fairly established.

The presence of *cartilage* in callus, as in the development of heterotopic bones is only temporary and due to excessive irritation.

In epiphyseal separations, the line of rupture is not through the cartilage of conjunction itself, but through the spongy layer at one or the other side. These injuries are repaired like wounds of bone rather than like those of cartilage. Even if immediately reduced, the growth of the bone in length is hindered as a sequel of the accident. On the other hand the thickness of the part will generally be permanently augmented.

The causes of *non-union* after fractures are rapidly discussed, and the labours, in this field, of our eminent townsman, Dr. Geo. W. Norris, briefly adverted to. With regard to the administration of phosphates in

cases of this nature, M. Ollier states that he has never been able to satisfy himself that they produced any good result; though he continues their use, from a conviction that at any rate they can do no harm. Our author has experimentally confirmed the views of Bernard and of Virchow, in opposition to those of Schiff, to the effect that section of the nerves of a limb produces no direct injurious effect upon the process of callus formation.

Fractures and wounds of the cartilages that have an investment of perichondrium, are united by an osseous or fibrous callus developed from that membrane. The edges of the cartilage themselves do not unite, though remaining in close juxtaposition. Wounds of the articular cartilages in very young subjects are united by a cicatricial tissue, which, however, assumes but imperfectly the characteristics of true cartilage. Wounds of the cartilages of conjunction unite by a cicatrix, which remains permanently fibrous.

Chapters Seventh and Eighth are devoted to a consideration of the regeneration of bones after resection or total excision; the former discussing the matter with regard to bones in general, and the latter taking up the question in the cases of the several classes of bones in detail. These chapters are full of interest, and replete with practical instruction. The principles and mechanism of bone formation, as described by our author, have, however, been so fully set forth in the preceding pages, that it will not be necessary for us to linger over the present portion of the volume. Suffice it to say, that M. Ollier has obtained complete reproductions of portions and even of entire bones in rabbits, cats, and pigeons, from the periosteum alone. We consider that he has well established the fundamental proposition, which he announces in the following terms: "The periosteum alone gives rise to veritable regenerations. Isolated from all other tissues of bone, it can, by itself, under certain circumstances, reproduce an entire bone, or a considerable bony portion, representing the form and fulfilling the functions of the organ removed." The remaining elements of bone tissue (marrow, cartilage, etc.) do indeed possess the bone producing power in a more or less limited degree, and under certain exceptional circumstances; but neither of them nor all of them together, *without the periosteum*, can be justly said, ever or in any way to exercise the property of causing a true *regeneration* of bone previously removed. "They undergo ossification in the neighbourhood of the periosteum, and aid it in its functions; but they cannot take its place."

While the process of regeneration in all bones is the same, the facility with which they can be regenerated varies greatly according to the nature of the bone concerned. In general terms it may be stated that the ease with which a bone can be reproduced is proportional to its thickness, and in the same bone reproduction will be most complete as regards those parts that are thickest. This depends upon the fact previously noted, that it is in those parts that the osteogenetic layer of the periosteum is best developed.

In the long bones, the central part of the diaphysis is the slowest of regeneration, and ossification not unfrequently fails at this portion, even when the epiphyseal extremities have been completely reproduced. The actual regeneration of the epiphyses has been doubted, it being supposed that the dilated extremities of the diaphysis took their place; but that they are really reproduced, is proved by the formation of new cartilages of conjunction, separating the epiphyses from the diaphysis as in the

natural bone. The only parts not reproduced are those covered with cartilage of incrustation. There is no periosteum in this locality, and of course no osseous regeneration.

M. Ollier has obtained in the dog partial regeneration of the humerus, after subperiosteal excision of the whole of that bone. The new formation was of the same general shape, though smaller, than the original bone, and it is to be specially noted that all the muscles of the part retained their relative points of origin and insertion, just as in the limb before the operation.

"In spite of the shortening of the member, a like result would be of inestimable value in the human subject, should it be determined to remove the whole humerus. The use of the hand would be in part preserved, and all the movements would remain possible to a certain degree. *In the lower extremity*" (the Italics are ours) "*the same result would be altogether insufficient, and would have totally different consequences in view of the functions of that part.* It must, on the other hand, be remembered that if the entire periosteum should be removed in a similar case, there would not be obtained even the shadow of a regeneration."

Flat bones may be divided into three classes; (1) such as are surrounded with muscular tissue, as the scapula, the ilium, and the sternum; (2) such as have their periosteum continuous with a mucous surface, as the bones of the palate; and (3) those whose periosteum is lined with a serous membrane, as the bones of the skull, where, as has been seen, the dura mater is a bone-producing agent. Our author has obtained complete reproduction of the scapula in the dog and in the cat, and of the palatine vault in the dog; in one case from the palatine periostem alone, that on the nasal surface having been destroyed. He has also obtained complete bony reproduction after trephining the skull of a sheep; though the regeneration of the cranial bones is as a rule unsatisfactory in the extreme. M. Ollier has obtained complete reproduction of the cuboid bone in a rabbit, and partial reproduction of the calcaneum in the same animal. He has not himself experimented upon the spinal column, but has in his possession a specimen given to him by Prof. Brown-Séquard of the reproduction of the posterior part of four vertebræ resected from the spine of a guinea-pig. The vertebral arches are fused together, but the spinal canal has been completely formed anew.

Chapter Ninth treats of the reconstitution of new joints between the reproduced articular extremities of bones. The difference in result, according as the periosteal and other fibrous constituents of the joint, with the muscular attachments, are preserved or sacrificed, is pointed out first as to joints in general, and secondly in the case of the individual joints, with the variations due to their nature as they belong to the ginglymoid, ball-and-socket, or mixed forms of articulation.

Not only is the preservation of the periosteum essential for the perfect reproduction of the articular extremity of a bone, but without it the *shape* of whatever new structure might be formed would be unsuited for the fulfilment of its functions. Moreover, besides serving as a mould to determine the form of the new material, the periosteum (together with the other fibrous tissues of the joint) acts an important part as a kind of internal splint to keep the articulation at rest during the period of the reproductive process.

In subperiosteal resections of joints as of the long bones, the attachments of the muscles are preserved, and in the new formation their points of origin and insertion will be relatively the same as in the natural condi-

tion of the part; whereas if the periosteum be sacrificed they will form new adhesions in irregular and vicious positions, and as a consequence the usefulness of the limb will be greatly hindered if not entirely abolished.

M. Ollier has obtained, by subperiosteal resection, almost complete reproduction of the elbow, knee, and shoulder-joints in the dog, and, which is still more important, an equally good result in the case of the latter articulation, in the human subject.

In Chapter Tenth are considered the mode of development and structure of reproduced bones and of new articulations. The process of formation of new bones in place of those removed by periosteal excision, does not vary from that heretofore studied in the production of heterotopic osseous productions, and in the repair of fractures and other injuries of bone tissue. It is, however, to be observed that the *cartilaginous* stage, which is exceptional in the case of heterotopic bones and in the development of callus, is the rule (though not uniformly observed) in the reproduction of bones after resection.

The reproduction is more perfect when portions of the original cartilage or bone remain in the periosteal sheath, than when such portions are entirely taken away.

The intermediate cartilaginous structure which exists between the new diaphysis and the new epiphysis, fulfils temporarily the functions of the original cartilage of conjunction. It is owing to this, that reproduced bones grow in length, to a certain extent, though they never attain the length of the corresponding bones of the opposite side. As a rule also they remain more slender than normal, though there are exceptions, as in the cases where an exuberant reproduction takes place, and where the reproduced part has been from the beginning more voluminous than the portion removed.

Reproduced bone presents many more centres of ossification than bone in its normal development. This is owing to the unequal activity of different parts of the periosteum. The earliest ossification takes place in the course of the periosteal bloodvessels, and in general terms the activity of the periosteum is proportional to its vascularity.

The diversity of appearance of the reproduced and of the old bone gradually becomes obliterated, at least as far as naked eye observation is concerned; for the results of microscopic examination of the newly-formed substance, the author refers to his chapter on the structure of heterotopic bones.

The modifications brought about in surrounding structures by the reproduction of resected bones, are the same in kind, if different in degree, from those observed in fractures and other bone lesions. The changes in the soft parts gradually disappear, but those in the adjoining bones usually remain permanent. Thus, if the radius be the bone resected, and the limb be used before sufficient reproduction has been effected, the ulna will probably become the seat of osteophytic developments, or even of general circular hypertrophy. On the other hand, the resection of one bone renders the other peculiarly liable to fracture, or it may bend without breaking, and serious and persistent deformity ensue.

After resection of joints, the ligaments and all the fibrous tissues contribute to restore in a measure the form and usefulness of the part. They thicken and become vascular, their plastic elements undergo proliferation, while their intercellular substance becomes softened and otherwise modified. Vascular granulations proceed toward the centre of the

articulation, and sometimes assume very much the consistence and general appearance of cartilage. New interarticular ligaments are developed, as are also fibrous disks, not unlike in appearance the loose cartilages occasionally met with in the articulations. When one articular cartilage has been preserved, a partial reproduction of the synovial sac may be noted; in other cases its functions are in a measure accomplished by the development of a kind of "bursa mucosa."

Chapter Eleventh treats of the general and local conditions of the regeneration of bone, and of artificial means for augmenting the reproduced osseous mass.

The perturbing circumstances which interfere with the success of experimental operations, are shown to be very much the same as those which affect the result in operations on the human subject. Neatness and care in the operative procedure, and careful and judicious after-treatment, are equally important in either case. Especially is it desirable that the parts involved in the operation should be afterwards kept at rest; as otherwise the new bone, even if sufficient in size, would in shape and direction be so irregular as materially to compromise the good which might, under other circumstances, have resulted from the operation.

The influence of *age* upon the success of subperiosteal resections is well marked. The very young and the old are alike unsuited for these operations. M. Ollier has succeeded best with rabbits of about three months, an age corresponding to from eight to fifteen years in the human subject. *Pregnancy* does not seem to produce any marked effect one way or the other. The *state of health* of the animal at the time of the experiment exercises, as might be expected, a decided influence upon the success or failure of the operation. *An intercurrent malady* may arrest the reparative process, or may even cause it to retrograde. *The febrile state* seems to have peculiarly the property of causing the absorption and disappearance of an ossification which has already begun. At one time M. Ollier lost thirty-five or forty rabbits in succession from an epizootic affection which prevailed simultaneously with the existence of erysipelas among his patients in the Hôtel-Dieu.

The *time* required for bony regeneration is very variable; in general terms, the sooner it begins the more perfect will it become.

With regard to the artificial means to be adopted to augment the amount of bony reproduction, we may refer our readers to what was said on the subject in considering the repair of fractures and the formation of callus. We may merely add, in this place, that the existence of a moderate amount of inflammation and suppuration is not only not injurious but even desirable; excessive suppuration, however, by destroying the osteogenetic layer of the periosteum will prevent the reproduction of bone.

In Chapter Twelfth we have a discussion of the growth of bones in general, and of the law of growth in the long bones. The experiments of Duhamel, Hunter, Floureus, and others, made by feeding animals with madder, are referred to, and their results stated to be confirmed by M. Ollier's personal observations. The soft tissues grow by interstitial formation; the bones merely by superposition. This is the rule, though experiments upon very young animals would seem to show that their bones have *temporarily* the power of interstitial growth as well.

The long bones grow (in length) by ossification of successive layers of their cartilages of conjunction. But they do not grow equally from either extremity. The humerus, tibia, and fibula grow chiefly from their

upper ends; the femur, radius, and ulna from their lower extremities. Hence a law of the greatest importance, which M. Ollier formalizes as follows:—

“In the upper limb, for the bones of the arm and forearm, it is the extremity which contributes to the elbow that grows the least.

“In the lower limb, for the bones of the thigh and leg, it is the extremity which contributes to the knee that grows the most.

“The two principal segments of the same limb are therefore found to be in an inverse relation towards each other; the bones of the upper extremity are also in an inverse relation with regard to the analogous bones of the lower extremity.”

The importance of this law, which our author has experimentally established (as has likewise, independently, Professor G. M. Humphrey, of Cambridge), cannot be overestimated. It explains why resections of the knee are in young persons followed by such marked arrest of development, while resections of the hip and ankle do not entail the same disastrous results. Conversely, in the upper extremity, great shortening follows excisions of the shoulder and wrist-joints, while resection of the elbow has not the same disadvantage. Again, in *amputations* of the upper arm, as the principal source of growth remains, the bone (if the patient be a child) will inevitably grow more than the soft parts, and conicity, if not ulceration of the stump, result. This is not the case in the thigh, where by amputation the chief source of bony growth is removed. On the other hand, a conical stump is very apt to follow amputation of the leg, but will not occur after the same operation on the forearm.

A curious corollary to the above propositions is established by clinical observations; this is, that the extremity of election for normal growth is also the extremity of election for morbid growths, tumours, etc. Thus, exostoses, enchondromata, etc., affect in the upper extremity the shoulder and wrist rather than the elbow, while in the lower extremity their favourite seat is at the knee rather than at either the hip or ankle. The same law is stated by Broca to be observed with regard to the lesions of rachitis.

Chapter Thirteenth treats of the influence of irritation and ablation of different parts of a bone on its growth. The general causes of hypertrophy, or of arrest of development and atrophy of a bone, can be readily understood from what has gone before. It must be borne in mind that the periosteum differs from the cartilage of conjunction in that the former may be excited to additional activity by either direct or indirect irritation. The latter, on the contrary, responds in this way only to indirect irritation, while arrest of its function, and consequent bone shortening, result from any direct irritation of its structure. Prolonged want of use, or paralysis, give rise to atrophy of bones as of soft tissues. There is, however, a temporary elongation, due probably to the absence of pressure, to which M. Ollier gives the name of “*atrophic elongation*.” There is likewise, in cases of amputation, an elongation of the bones above the seat of the operation, and in cases of resection, an elongation of the bones both above and below. This is important, for it may sometimes serve to compensate in some degree for the arrest of development, which is uniformly observed in the bones immediately concerned in the operation. It is to be noted, however, that M. Ollier has not had occasion to observe this elongation in the human subject, though he has repeatedly noticed it in his experiments upon cats and other animals.

The peculiar reaction of the cartilage of conjunction, accordingly as it

is irritated directly or indirectly, is well illustrated by the difference observed in cases of fracture of the shaft of a bone, and in cases of epiphyseal separation. In the former there is a positive elongation, which may compensate for a slight amount of overlapping; in the latter there is always arrest of development, no matter how soon or how perfectly the separation may have been reduced.

Chapter Fourteenth, the last of the first volume, treats of *osseous grafts*.

M. Ollier has repeatedly obtained heterotopic bones by transplantation of periosteum; these bones are, however, not unfrequently after a time reabsorbed. But as it is a physiological law of universal applicability that the *stimulus of use* tends to the preservation and development of a part, it is possible that transplantation to supply a missing organ, such as the nose, would be more permanently successful than it is in experiments, which, however interesting and important, are of no physiological advantage to the animal concerned.

Hetero-periostic grafts, that is, from one animal to another of a different species, fail. M. Ollier has tried the experiment in sixty instances, and in only one obtained a success of very doubtful nature. In animals of the same species, however, the graft succeeds even after the animal from which the periosteum is derived has been dead twenty-five hours. The maintenance of a low temperature is essential for the success of the experiment, as above 16° C. (60°.8 Fahr.) putrefaction is very liable to ensue. M. Ollier has succeeded, with a temperature of —2° C. (+28°.4 Fahr.), but —10° C. (+14° Fahr.) is apparently too low. The maintenance of vitality of the transplanted periosteum is assisted by wrapping the part in a moist cloth. Brown-Séquard has found that the contractility of muscular tissue is restored thirteen hours after death by injection of arterial blood, and it is possible that the same means might be used to preserve the periosteal graft.

A heterotopic bone having been produced, its growth may be sometimes stimulated by moderate irritation. But the experiment is full of risk, and very apt to cause reabsorption rather than increased ossification.

Not only can heterotopic bones be developed by periosteal transplantation, but whole bones can be successfully grafted, as M. Ollier has experimentally proved in the case of rabbits, though he has failed with dogs. These grafted bones continue to grow in thickness, but do not increase in length. An exception is to be noted in the case of *white rats*, as shown by the experiments of Bert.

We have thus concluded our review of the first, or experimental portion of M. Ollier's great work. Our analysis has been necessarily very brief, and we have been compelled to pass very lightly, or even omit altogether, many points of great interest and practical value, which were, however, not absolutely essential to a comprehension of the object and scope of the main argument. We shall next proceed to a consideration of the clinical portion of M. Ollier's book, which occupies the second and larger volume of this most important contribution to surgery.

Fortunately (as our review has already extended to a considerable length), M. Ollier's second volume does not require, nor indeed would it admit of an analysis such as we have offered our readers of the first. The practice of subperiosteal surgery is, as yet, in its infancy; and our author's views are therefore confessedly, in a great many instances, theoretical, though perfectly reasonable, and probably hereafter to be confirmed by actual clinical observation.

M. Ollier writes for the future, as much, if not even more than for the present, and hence he has taken care by repeated observation and practice on the dead subject, to ascertain the best and most suitable procedure in the case of every subperiosteal operation which he has proposed. His book may thus be regarded as not only an admirable exposition of the present state of science as regards the subject of his labours, but as also an elaborate and satisfactory manual of operative subperiosteal surgery. Nor has our author limited himself to the bounds of his own special field of investigation; his work contains several distinct chapters, besides innumerable incidental remarks, upon the subject of bone-surgery in general.

Chapter First treats of necrosis in man, and of the regeneration of necrosed parts. The various forms of necrosis, and the antiquity of the fundamental principles of their treatment, are considered, with the process by which osseous regeneration is in such cases accomplished. The right time for surgical interference, and the means which may be employed to hasten the separation of sequestra are referred to, and we are pleased to observe that our author adheres, except in particular cases, to the time-honoured and most judicious rule, not to interfere until nature has done all that she is capable of accomplishing. Among the exceptions alluded to, are cases of necrosis of the upper and lower maxillæ, in which a positive injury is inflicted upon the patient by the presence of a constant source of infection and of systemic poisoning in the mouth, and in these cases the surgeon is therefore not only authorized to interfere before the separation of the sequestrum, but is positively reprehensible for neglecting to do so. With regard to the various plans proposed for hastening the loosening of sequestra, our author states that he has found all unsatisfactory, and some not free from danger.

Chapter Second considers the "abrasion, hollowing out (*évidement*), and cauterization of bones, or losses of substance which do not involve the length of the bone, and the method of bony reparation in such cases." The indications for each of these several modes of treatment are clearly pointed out, and their limits of applicability plainly defined. Our readers are doubtless aware, that the eminent Strasbourg surgeon, M. Sébillot, has lately given a fresh impetus to the practice of the process of hollowing-out diseased or dead portions of bone, and has given the operation the name of "*évidement*," by which it is here indicated. His learned and excellent treatise "*De l'évidement des os*," receives proper and respectful attention at the hands of M. Ollier, but the latter has, we think, conclusively shown that the process of *évidement* is only applicable to a limited number of cases, and not at all to those in which subperiosteal resection is especially indicated. Still the method of M. Sébillot is of great value, and our author has himself employed it with most gratifying results in several instances. It is especially useful as a supplementary operation after resection, as by this means the entire removal of the diseased structure can often be accomplished, without the sacrifice of such a large portion of the entire thickness of the bone as would otherwise be required.

In Chapter Third, the regeneration of bones by their periosteal sheaths is again brought under consideration; and cases adduced which prove the fact, in one, by demonstration on the living subject of the form of the new bone and the re-establishment of the limb's functions, and, in another instance, by the result of post-mortem examination, the patient having lived three years subsequently to the time of the operation.

The first case referred to is that of a young girl of fifteen, from whom M. Ollier removed by the subperiosteal process the upper half of the left humerus; the bone, in spite of several untoward occurrences, was completely regenerated (except, of course, the articular head) in less than a year; and the patient was able at the end of that time to return to her usual employment, a living monument not only of M. Ollier's surgical skill, but, what is more important, of the truth and practical applicability of his doctrines on the subject of subperiosteal surgery.

The other case is that of a young man upon whom our author performed excision of the whole thickness of the sternum, with resection of the costal cartilages; the patient dying of tuberculosis three years afterwards, an autopsy showed bony reproduction of the sternum, and ossification, more or less complete, of the fourth, sixth, and seventh costal cartilages on both sides, and of the third upon the left side.

Several cases are quoted from the writings of the older surgeons, such as White, Vigarons, Delamotte, and others, in which bony reproduction was observed; cases which at the time were considered merely as surgical curiosities, but which are now seen to have been the natural results of the normal physiological action of the periosteum. One fact which it is important to bear in mind in examining the results of cases reported by the older surgeons, is that while in some cases the separation of the periosteum is only to be accomplished by a tedious and painstaking process, in others it is almost impossible to avoid its preservation, the periosteum in such cases adhering more closely to the soft tissues than to the bones. Such is the state of affairs with the healthy bones of children, as well as in cases of inflammation, etc., in the adult.

Chapter Fourth takes up the subject of subperiosteal resections in general, giving rules for the operative procedure, and studying the conditions of osseous regeneration. We cannot pretend to follow our author into the minute directions which he lays down for the guidance of the surgeon in the case of each particular operation, but may say, in general terms, that the incisions should, as a rule, be single, in the direction of the axis of the limb, and as much as possible involving the intermuscular spaces rather than the muscles themselves. If it be necessary in any case to divide a muscle, it should be done in such a way as not to compromise its principal nerve. The periosteum is never to be detached with the cutting edge of a knife, but with the handle, or better still a kind of rasp, which the author describes and figures under the name of "*sonde-rugine*." Care should be taken to preserve the deep (osteogenetic) layer of the periosteum by pressing firmly against the bone in the process of separation. This part of the operation may generally be facilitated by previously dividing the bone with a chain-saw or otherwise at the middle of the portion to be removed. Great care must, of course, be exercised not to separate the periosteum from the surrounding soft tissues.

It is generally recommended, after a resection, to clip off with scissors all the fungous excrescences which are found on the surrounding fibrous structures; M. Ollier finds it better to allow them to remain, but he recommends that they should be freely touched with the actual or potential cautery (nitrate of silver). In these cases the wound must be kept open, and should be dressed with stimulating applications: in traumatic cases, however, the dressing should be of the simplest and most emollient character. The limb must, of course, be kept at rest after the operation,

with appropriate means of extension and support, to prevent undue shortening or other deformity.

After an ordinary resection, the rule is to place the resected parts in contact; in the subperiosteal operation this rule must be modified in view of the anticipated osseous reproduction. In a young subject, and especially in the upper extremity, the parts may be kept fully extended; but where there is reason to fear imperfect regeneration, and generally in the lower extremity (where more than in the upper it is necessary to avoid the risk of a false joint) it will be found better to approximate the resected extremities or even sometimes to place them in absolute contact.

Subperiosteal, as compared with ordinary resection, is a more difficult and much more tedious operation. This is however a matter of but slight importance since the general introduction of anaesthetics. Its results are more satisfactory, and there is reason to believe, though it cannot as yet be positively asserted, that it is an operation which is attended with less risk to life than is that of resection when the periosteum is not preserved.

Chapter Fifth treats of the general indications for subperiosteal resection, in hospital practice, civil (domestic) practice, and military practice respectively. The author remarks, and we think very justly, that it is a pity that hospital practice (as it nearly always does) should establish the rule for military (field) surgery, rather than country practice, to which the work of the army surgeon very often more nearly approximates. Thus certain operations, as for instance excisions of the knee-joint, are almost universally fatal in hospital practice, while in the healthy surroundings of country life they do very well. This particular operation is not of course generally suitable in military practice on account of the question of transportation; but with regard to other excisions and resections, and especially those of the upper extremity, our author thinks, and we quite agree with him, that a new field is opened to conservative military surgery by the subperiosteal mode of operation. Many cases, of course (shocking as it may appear), must and will still be amputated *to save time*; for, after an action, *time* is an element that demands the gravest consideration of the medical officer; but there are many other cases which do not require immediate attention, and it is for these especially that subperiosteal resections are particularly adapted. It is indeed in secondary operations that the best results may often be expected from the subperiosteal method, for in such cases the inflammatory action will have not only loosened and thickened the periosteum, but will have already prepared it for the most perfect exercise of its osteogenetic and reproductive powers.

In civil or hospital practice the cases of traumatic origin in which the question of resection is involved, are compound dislocations, and compound fractures where a fragment projects through the skin.

In the former, we entirely agree with M. Ollier, that primary subperiosteal resection should be invariably practised. In the latter, our author advises that where the fragment is bared of periosteum, and even if not, in the case of a child, the projecting portion should be resected previously to attempting reduction; we confess that we have rarely seen any advantage from this mode of proceeding in the cases in question, and should usually prefer, where amputation was not indicated, to trust the case to nature, reducing the fracture as completely as possible, by the aid of free incisions of the soft parts if necessary.

In cases of compound fracture involving the larger articulations, M. Ollier likewise recommends subperiosteal resection. He has done the operation himself in one case of compound fracture of the elbow-joint,

but the patient unfortunately died of pyæmia, so that the result, as regards bony reproduction, could not be determined. We confess that, with our present light, we should prefer, unless the fracture was very limited in extent, to resort to amputation, believing that by so doing we were affording our patient the best chance for preservation of life.

Cases of acute osteitis, of acute subperiosteal abscess, and even of acute osteomyelitis, when confined to the diaphysis of a bone, can often be successfully treated by the lesser operations of scraping, cauterization or *évidement*, and even sometimes without any operation at all; when, however, the disease attacks an epiphysis, and the neighboring joint becomes involved, the case is more serious, and resection, or if more than one joint be involved, amputation must often eventually be resorted to. But even in these cases, the operation should not be employed until all ordinary modes of treatment have failed; for, thanks to the labours of Bonnet and others, the prognosis of suppurative arthritis is not now considered so uniformly unfavourable as it was formerly.

In neoplastic formations of bone, whether malignant or otherwise, subperiosteal resection should be avoided; here the preservation of the periosteum is at best of but doubtful utility, and must often prove positively injurious by reproducing the disease; hence in these cases the rule must still be, as formerly, total excision or amputation, according to the nature of the bone affected.

There is another class of cases where subperiosteal resection may sometimes be usefully employed, viz., where the operation is required as a preliminary to the removal of deep-seated tumours, as for instance in the maxillary sinus.

Chapter Sixth treats of the subperiosteal resection and ablation of the bones of the head. Sundry interesting cases are given in which the upper and lower jaws or portions of them have been severally removed, but no reference is made to the very important case communicated by Dr. William Hunt, of this city, to the Philadelphia College of Physicians, and published in the number of this Journal for April, 1865 (p. 353), and January, 1866 (p. 163). This case, as well as that of Dr. Charles S. Boker (see *Am. Journ. Med. Sci.* for April, 1865, p. 555), either operation being for phosphorus disease, seems to us to prove both the possibility and the propriety of removal of the lower jaw being effected *without external incision*.

M. Ollier seems not to have been acquainted with either of these cases, for he bases his objection to the operation without cutaneous wound upon the *extreme difficulty* of the procedure, stating, indeed, that the operation is practicable upon the cadaver, but should not be attempted upon the living subject. Not only do Dr. Hunt's and Dr. Boker's cases show that the operation is far more easy than supposed by M. Ollier, but we may add that the bony regeneration in Dr. Hunt's patient was more complete than it seems to have been in most if not all of the cases which our author details in the chapter under consideration.

We do not propose to follow M. Ollier in his remarks upon subperiosteal resection as applied to each separate portion of the human frame; suffice it to say that he has practised this method with greater or less success upon the clavicle, scapula, ribs, pelvic bones, humerus, ulna, tibia, fibula, and bones of the hand and foot. Minute and careful directions are given for the operative procedure as applied to each bone, and illustrative cases from his own practice and that of others fully detailed, the results conscientiously stated, and justly and reasonably appreciated.

The same plan is adopted, in Chapters Tenth to Twelfth, for the subpe-

riosteal resections of the joints. Our author has operated in this way upon the shoulder, elbow, and ankle-joints, and generally with very gratifying results. Excision of the hip he has not performed at all, and in resections of the knee he has not attempted to obtain bony regeneration, preferring to place the cut surfaces of the femur and tibia in contact, and even to unite them by suture, with a view to obtaining bony ankylosis.

In his thirteenth chapter, M. Ollier treats of "some accidents in cases of fracture, due to exuberant or defective callus." Under the first heading is narrated an extremely interesting case, with which (as it has been extensively quoted by other journals from the *Gazette Hebdomadaire*, in which it first appeared) many of our readers are doubtless already acquainted. In this case the radial nerve was, after a fracture of the humerus, compressed between a projecting point of bone, and a canal which was formed around it by an excess of callus; great pain, and afterwards complete paralysis resulting from the accident. M. Ollier, six months after the occurrence of the injury, cut down upon the part, and with a chisel and mallet formed a wide groove in the callus, and removing the offending point of bone, brought the wound together; thus leaving the nerve completely protected by a bony wall, which at the same time did not compress it in any part. The wound soon healed, and in a year the nerve had completely regained its normal power, the patient being able to use his hand in every way, though it was still slightly weaker than its fellow.

With regard to the operation of subperiosteal resection in cases of ununited fracture, M. Ollier insists upon the importance of suturing the resected portions of bone themselves, but attributes no advantage to the suture of the periosteum. Our readers will observe that this is precisely the plan which has been so successfully adopted in this country by Dr. Henry J. Bigelow, of Boston. [See No. of this Journal for Oct. 1867, p. 507.]

Chapter Fourteenth treats of periosteal and bony grafts in the human subject. Our author upon one occasion transplanted a strip of periosteum obtained from the tibia to the forehead, as a preliminary to the operation of rhinoplasty; the result was, however, not sufficiently encouraging to tempt him to repeat the proceeding. The graft had apparently become entirely gangrenous, and it was only in tearing it away with forceps, that the screams of the patient, and a few drops of blood, showed that it had actually contracted adhesions at some points.

An account is quoted from Percy, of two attempts made by that distinguished surgeon to supply a loss of substance in gunshot fractures of the tibia, by the introduction of pieces of *beef bone*: the attempt, it is needless to say, resulting in complete failure.

A good, but somewhat apocryphal story is also quoted from Job à Meckrem, of a soldier, who losing by a sabre wound a considerable portion of his skull, had the deficiency supplied from the head of a dog, which was immolated for the occasion. The cure (so the story goes) was perfect, but the matter unfortunately coming to the ears of the patient's father confessor, absolution was withheld until the surgeon's dirty work had been undone, the foul fragment cast out again, and the patient eventually submitted to a more Christian mode of treatment.

Chapter Fifteenth treats of osteoplasty in general, and of its two varieties, the direct or osseous, and the indirect or periosteal. The principal applications of these proceedings are in cases of rhinoplastic and uranoplastic operations. Langenbeck, after an operation of periosteal rhino-

plasty, demonstrated the formation of new bone by extracting a piece and placing it in the field of a microscope. M. Ollier has not made the direct examination, and has only been able in one of five cases to satisfy himself that a true bone formation had taken place. The details of this case are given, and the appearances before and after the operation represented by a plate. In Dr. Bigelow's case, it will be remembered, the result was completely unsuccessful.

Chapter Sixteenth and last treats of "preliminary osteotomy," a new operation for naso-pharyngeal polypus, and of amputations with a periosteal flap. The new operation seems to be exceedingly ingenious, and, judging from the reported cases in which it has been practised, very successful; but as it is not very often required, we do not think it worth while to occupy our limited space with its description, preferring to refer those of our readers who may be interested in the matter to M. Ollier's volume itself.

With regard to the preservation of a periosteal flap in amputations, though our author first suggested the practice, he is now by no means convinced of its utility. An exception is however to be made in the case of the tibia, where, by the adoption of this plan, M. Ollier thinks the surgeon can avoid the perforation of the anterior flap by the tibial spine, which is so often observed after the operation as ordinarily performed.

Two appendices conclude the volume, one giving the details of three observations (by Coutavoz, Vigarous, and White respectively), which were only alluded to in the main part of the work, and the other furnishing later reports of the condition of several patients whose cases were not terminated when the book was placed in the printer's hands.

We have thus completed our review of this magnificent result of M. Ollier's labours, and, in taking leave of the work, cannot but express the opinion, that not only the profession but mankind at large owe him no inconsiderable debt of gratitude for his most valuable contributions to the science and art of surgery. There are some slight inaccuracies in his book, which will doubtless be corrected in a subsequent edition; thus, on page 207 (Vol. II.) we are told in the third, sixth, and ninth lines respectively, that the same patient was fifty-seven, fifty-four, and fifty-one years old. If we were to indicate a fault, it would be that the work is rather too much spun out; there are a good many repetitions, and a good many matters which though sufficiently interesting in themselves, do not strike us as particularly pertinent to the subject under discussion. We fear that the length of the volumes will stand in the way of their general circulation, at least in countries other than the author's own; for not only is the cost of so elaborate a work a matter of consideration with most doctors, but the perusal of a thousand large pages in a foreign language, is a task which by many will be approached with misgiving, if not altogether declined.

M. Ollier's style we have found perspicuous, and, usually, sufficiently elegant: he has, however, as we have already indicated, not learned that in which Pope tells us even Dryden was deficient—

"The greatest art of all—the art to blot."

Although not free from misprints, these volumes, both as to press-work and paper, reflect great credit upon MM. Masson, the publishers; and the nine plates and forty-five wood-cuts, while characterized by the usual French artistic elegance, are also remarkable for being executed with perhaps even more than the usual French accuracy.

J. A., Jr.